

THE LIVING WORLD GEOGRAPHIES

BOOK VII

WORLD'S FOOD AND COMMERCE

BY

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THE LIVING WORLD GEOGRAPHIES

- I. The World in Outline
By J. T. MULLEY
 - II. The British Isles
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By J. T. MULLEY
-

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FOREWORD

This book, the seventh of the series, is an attempt to place before the older children of the Senior Schools an account of the food supply and commerce of the world. The very complex subject with which it deals can be treated in several ways, and there will always be differences of opinion as to which is the best. It is hoped, however, that the plan followed here will be generally approved, and that the book will be helpful to those geography teachers who try to make man's needs, and the means by which those needs are satisfied, intelligible to their pupils.

The attention of teachers is called also to the illustrations. These have been chosen with great care, and it is believed that they will help children to visualize unfamiliar commodities and processes. In many cases the sources from which illustrations have been obtained are acknowledged below the pictures. For the numerous Australian and South African photographs reproduced thanks are due, and offered, to the Governments of the Commonwealth and of the Union.

J. T. MULLEY.

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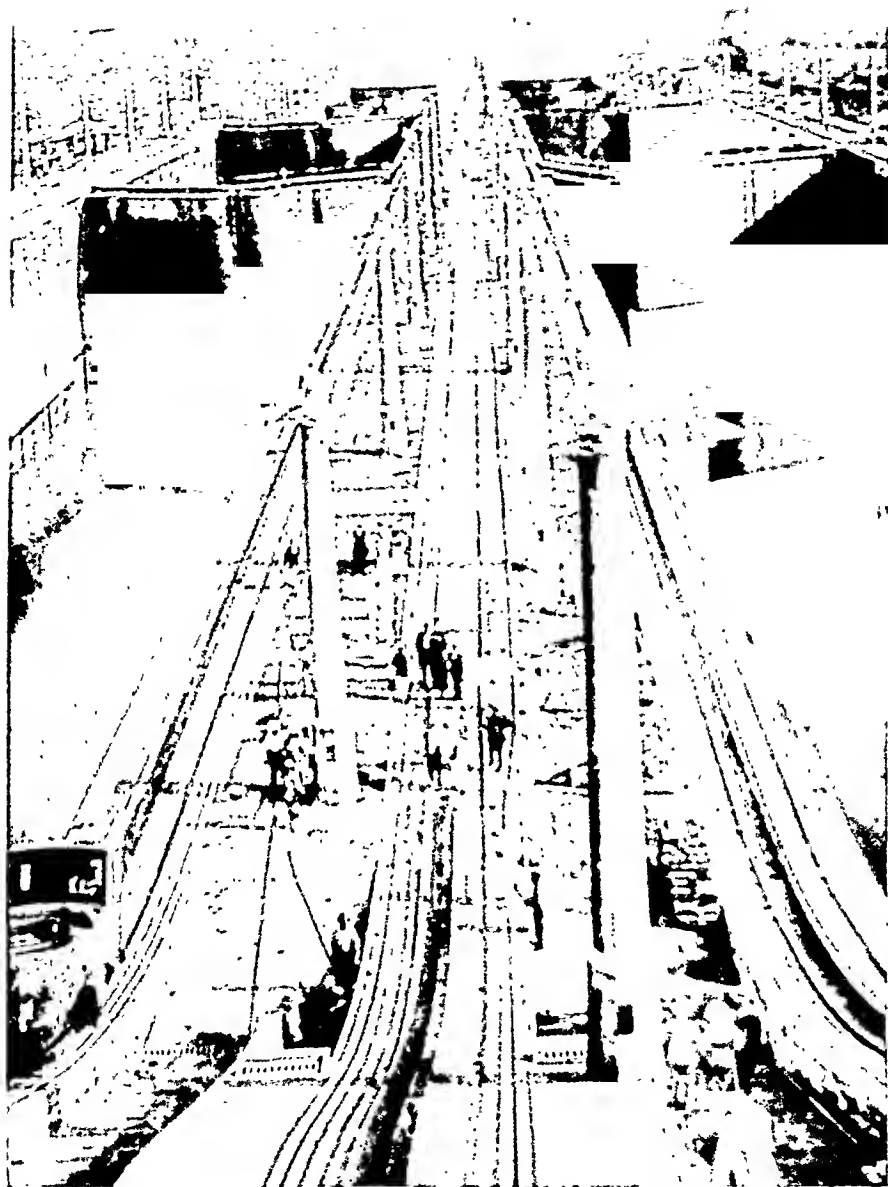
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PANAMA CANAL

[Photo : E.N.A.]

A striking view of the Gatun Locks, looking towards the Atlantic. The canal, which was opened in 1914, belongs to the U.S.A. Through it the largest vessels afloat can pass between the Atlantic and the Pacific (see also pp. 152-5).

I. THE BEGINNINGS OF TRADE

There are nowadays very few parts of the world inhabited by people who live solely upon the food which they themselves grow. This is particularly true of the countries of Western Europe and of the United States of America. In the industrial parts especially, huge supplies of food and of raw materials are brought almost every day from oversea ; and to the food-producing lands manufactured goods are sent in return.

Early Days. There was a time in the history of the world when almost every man, living alone and hunting alone, had to grow, catch, find or make everything he used ; and of many things he made a clumsy, untidy mess, for he had not the knowledge, or the skill necessary, to be clever at so many kinds of work. When people began living together in villages, the men who were best at making digging-spades or hunting weapons from flint, or best at keeping sheep, began to do those things all day long, while others supplied them with food, in exchange for the things they made or the work which they did.

In this way each man spent his time doing that sort of work for which he was specially fitted ; and, with practice, he became so much quicker and more skilful that tools and other things were much improved and made easier to use. Thus work was better done, and the world grew richer ; for the good farmers farmed all day and grew better and bigger crops, instead of wasting hours, when they might have been hoeing or ploughing, trying to make their own trousers, or their own axes for wood-chopping. But some unlucky people were forced to do things they did not like, because others stronger than they would not do the nasty jobs.

“ The Starving Month.” No one part of the world can be made to grow everything. Dates will not grow in England, nor will figs, olives, tea, rice, or spices. So, in the days before it was possible to obtain these things from warmer parts of

the world, folks living in England and other temperate lands had to do without them. Boadicea, and even King Alfred, could not have sugar in their tea. They used honey for sweetening, and probably had not even heard of tea, much less seen it, or tasted it. Dukes and princes of Norman days in England, before the beginnings of world-trade, most certainly did not know the taste of bananas, nor yet of potatoes.

It is easy for us, knowing this, to begin to understand how much the poorest of people have profited by the growth of world-trade, and by the development of steamships and railways, which convey to a country things that will grow only in other climes.

From Saxon days even to the time of Queen Elizabeth and after, the month of May was spoken of as "the starving month," for the crops of one year were mostly eaten, and those of the next were not yet ready for harvest. In Ireland, well on into the 18th century, June was often a terrible month for the farmers of the west to live through, for the potatoes of the new crop were not ready, and the old crop was finished. Food, in plenty in one land, could not be rushed to a starving people, before railways made possible speedy transport of heavy goods.

EXERCISES

1. Make a list of fruits which can be seen in a greengrocer's window.
2. Which of the fruits in common use to-day were not known in King Alfred's time?
3. In what ways is life in England to-day better than life in the time of Boadicea? In what is it worse?
4. Write a short essay on "Famines."

II. NEEDS OF MEN

Men must have food and drink; and they must have shelter from the burning suns of tropic climes, from the pelting rains of monsoon lands, and from the stinging frosts and biting winds of the icy regions around the North and South Poles. Food, clothes and shelter, in short, are man's absolute needs.

Food to keep the body living and working; clothes to wear as an immediate protection; and some hole or cave, or house to cower in when rain or winds or sun beat very violently—

these are the wants that man must work and strive for, in order to satisfy his own instinctive desire to live. The air he needs and breathes is free. In large industrial areas, however, it is too often mixed with soot and stench and noisome germs; similar dangers lurk near the edges of marshy lowlands, and tropic malaria and mosquito-infested swamps.

Food. People eat when they are hungry, when they think they ought to be hungry, or when something they like is there to eat. But the human body is really a machine—a living engine which must help, daily, hourly, to rebuild itself, as well as to maintain its own internal fires, and do work. For this, fuel in the form of solid food and water—either pure, or flavoured, as in the case of tea, coffee, beer, wine and the juice of fruits—are as necessary to it as are coal and water to the steam-engine. Indeed, they are more necessary. The steam-engine has not to remake itself or replace its parts as it works. The living engine of the human body, on the other hand, has to work and to replace its worn-out tissues as it works.

For many generations the typical Anglo-Saxon foods for all this bodily repair and growth (for the human engine has to grow as well as work and repair its worn-out tissues) were “bread and beef and beer.” The bread was often poor stuff, made of home-grown wheat and rye, black, heavy and unpalatable; and the beef was tough, and salt in winter. Often there was no beef for poor people but only poor, half-salted bacon, or cheese; and peas and beans supplied the place of bread when wheat crops failed or when, as sometimes happened in wet and stormy harvest seasons, the rye crops rotted.

The beer was thin and weak, mere small-ale, home-brewed. But the water in it had been boiled in the brewing; and the barley gave that water a flavour and a medicinal quality which made it suitable for summer days when unboiled water, drawn from standing pools or ponds that no one troubled to keep pure and clean, was a perilous drink.

People of the commerce-fed days of the 20th century would squirm and cringe at the very sight and smell of the bread and beef and beer which, with a few eggs from the skinny fowls that sought a living on the village green, and an occasional draught of milk from a half-starved cow, formed the main

meals of the self-supporting villagers of early and mediæval England. Yet with cabbage-kale and onions, with crab-apples, and with acorns and beechmast filched from the rooting swine in the woodland wastes, this rough, coarse fare formed an almost perfect combination of the body-foods which learned men, as a result of their studies, now prescribe.

Main Food Constituents. There is water in all solid foods to a greater or less degree, and lean meat contains a big proportion of a chemical substance called *protein*. Protein is a muscle-building food.

Bread and all kinds of flour, potatoes, rice, and even bananas, contain a great deal of starch. Fruits—apples, oranges, grapes, etc.—and such things as carrots and beetroot contain some form of sugar. Starch and sugar may not taste alike, but they are very much alike in their chemical composition or make-up. Both are compounds of carbon and water and are called the *carbohydrates*. From the carbohydrates much of the energy of the human body is obtained.

Butter, lard and olive oil are edible fats; nuts also contain much fat. Some fat is necessary to the human body, for without it the other foods digest too quickly and a man seems always to feel hungry and loses weight. Fat also helps to keep the body at a steady normal heat. Much fatty food is needed, therefore, in very cold climates.

Green vegetables do not supply much direct food to the body, but they—and milk, too—have in them some curious substances called *vitamines*. These act upon the other foods eaten, and help to make them nourishing. Green vegetables supply to the body mineral salts.

The proportions of some of the common foods may be roughly stated as:

	WATER	PROTEIN	FAT	CARBO- HYDRATES	WASTE
FLOUR (white)	12.5	11	1	75	.5
BREAD	35.3	9.2	1.3	53.1	1.1
POTATOES	78.5	2	.1	18.5	.9
„ (later analysis) . .	62.6	1.8	.1	14.7	20
BANANAS	50	1	.5	14.5	31
RICE	12	8	.5	70.0	.5
BEEFSTEAK	51	16.5	16.5	—	13
MILK	87	3.3	.4	5.0	.7
PEAS (dried)	9.5	21.6	1	62.0	8

Foods which are rich in protein are often called *nitrogenous foods*, for they contain much nitrogen. Nitrogen forms with oxygen the air around the earth.

Clothes. Many thousands of years have elapsed since primitive men wandered about clothed in nothing but their own thick, matted hair; or even since the earliest of civilized men stopped wearing the skin of a wolf or deer or sheep, and wove cloth from which to make garments.

Ten thousand years ago men had learned to weave the fibres of flax and hemp, but it was not until the invention of steam-driven machinery that huge industrial centres grew up around the factories where the engines drove the weaving machines, and so led to the present-day vast interchanges of raw vegetables, fibres and food for manufactured goods, and to the commerce in iron and other metals from which the machines are made.

EXERCISES

1. What are the chief needs of man?
2. Why do Englishmen in India often wear white cotton or linen suits?
3. In what respect does the human body resemble a machine? In what is it different?
5. Why did some people starve in ancient days when a hundred miles away might be plenty of food?
6. Why was harvest-time in England more important in the reign of Edward II than it was in the days of Edward VII?

III. AGRICULTURE AND CLIMATE

Meat, wheat, wine; apples, pears and plums; pepper, nutmegs and other spices; rice, sugar, tea—in fact, all the thousand and one things that men eat are grown from the soil, the outer covering or crust of the solid part of the world. Common salt, perhaps, is the only exception. Salt is part of the earth's crust, or is found in the water of the sea.

Man cannot directly eat the sand, mud, stones, or clay which form the solid crust of the earth, but the food he needs, whether nitrogen of the air or mineral salts of the soil, must first be made digestible for him by the plants and creatures growing and living on that crust or in the sea. Grass grows out of

the ground, under the beneficent influence of the sun and rain. Sheep and oxen eat the grass. Then man eats the meat of the grass-fed sheep and oxen. Some of the grasses, improved almost out of all resemblance to their early forms, produce seeds, like the kernels of barley, wheat and maize. Man eats these things also, and so lives; without their aid in turning the mineral matter of the soil into edible food he would die.

So everywhere, whatever his occupation may be, man is keenly interested in agriculture—in the growing of plants and crops from the ground, and in the weather conditions under which the plants will best grow, so that the supply of food available may be plentiful and certain. Wild plants and trees may produce food for the taking, but the supply is often uncertain, though, by studying the natural trees and plants of any region, men may learn what kinds are most likely to produce the necessary quantities.

Some men, busy all day mining coal, digging iron, weaving cloth and so forth, are apt to forget this. But, if the world should suddenly turn into a vast Sahara, or into an icy desolation like the lands around the Poles, they would soon be reminded.

The sunshine and rain, the wind and the fog that together make up the weather of a country, and the soil which, acted on by them and by the efforts put forth by man to aid or direct, cause plants and animals to grow. In other words, the climate and agriculture of the various parts of the world are the foundations of man's continued life; and they alone render possible the trade and commerce which makes that life fuller and more enjoyable.

Coal and iron are added helps to trade; they aid in making the transfer of life-giving foods, and of life-preserving raw materials like wool and cotton, easier and more certain. This applies also to gold and silver and to other minerals underlying the surface soil.

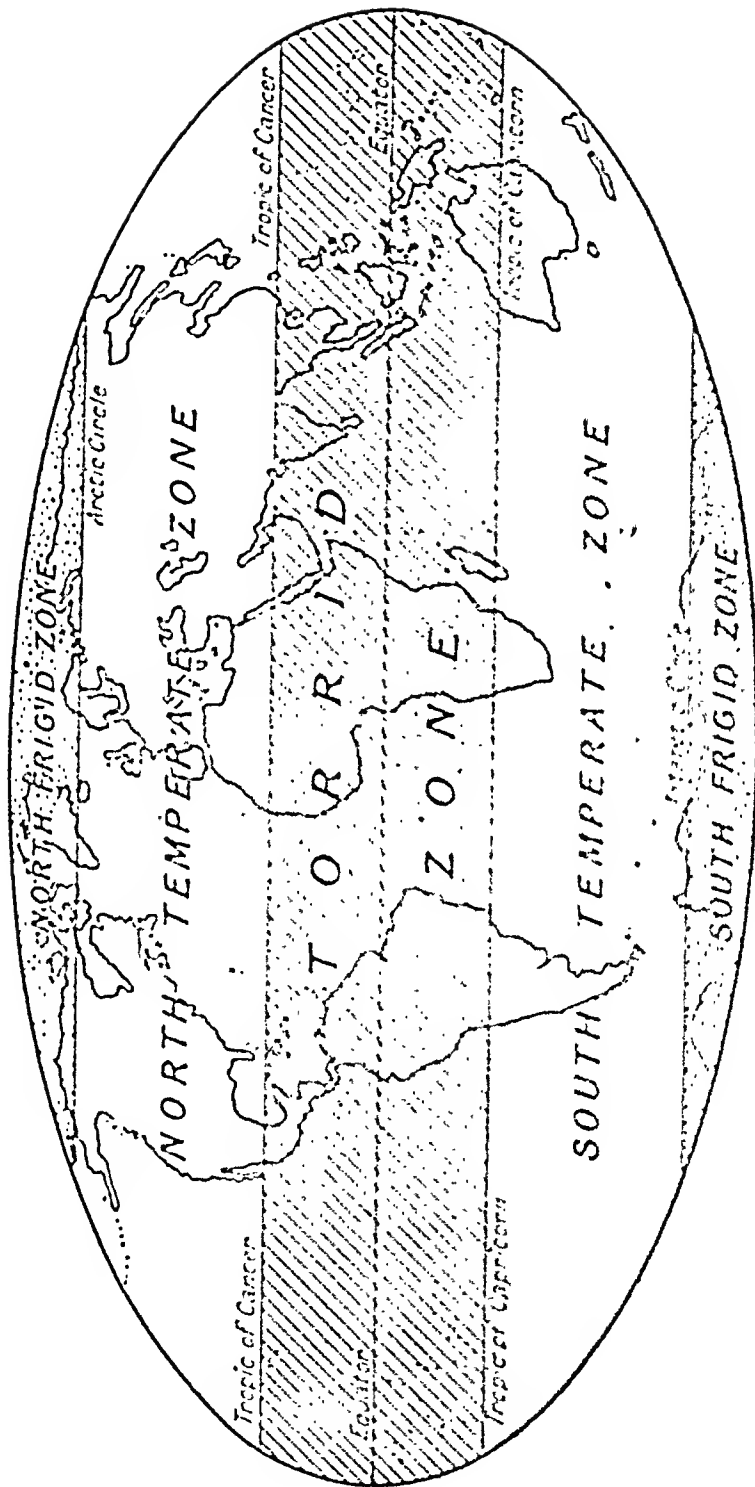
Gold and silver help, for they have been the money of the world for ages, the easily-carried and much-wanted things for which men will readily give their corn and wine and oil and fruits, knowing well that other men will accept them in turn for goods they have to spare.

How Plants Grow. Plants take in from the soil, with the water they absorb through their roots, such mineral foods as they need. There are many different substances in a well-mixed soil; and some of them dissolve in water, in the manner of sugar and salt. Not all the rain that falls on the earth's surface runs down to the rivers and lakes; some sinks into the soil, and, as it passes between the tiny particles of sand, chalk, lime, clay or whatever the soil in any district may be composed of, forms a film of moisture that draws into itself some of the solid matter of the soil. Plant roots drink in this moisture and with it the mineral matters which the moisture holds in solution. Much of the moisture the plants breathe out later through the pores in the undersides of their leaves, but they keep the mineral foods, and from them build up the fibres of their stems and branches.

In order that they may turn the mineral matter they absorb into vegetable fibre which man can eat, or weave and wear, plants need light and heat, as well as moisture. They cannot live and grow strong in the dark, nor can they grow in the icy cold of Polar regions or of freezing mountain peaks. Sun, rain and soil are all needed for plant growth. So the tallest trees, the thickest forests and the most varied forms of plant and animal life are found where the soil is deepest, the rain most frequent, and the sun's light and heat very powerful. There, too, can man most easily find the food he needs.

Weather Belts of the World. The world is a big globe which spins in space and revolves, as it spins, around a central larger sun. From this sun is radiated continuously in all directions the heat and light which are necessary for animal and vegetable life.

Wherever the rays of heat and light strike the earth from the noon-day sun shining nearly directly overhead, there the weather is very warm, the temperature being higher, year in and year out, than the average of an English summer season. The earth spins round in a slanting position, like a lop-sided top. One result of this slanting position is that a central belt, extending some $23\frac{1}{2}^{\circ}$ on each side of the Equator, is brought for a part of the year directly under a vertical sun at noon.



THE WORLD IN ZONES

The Frigid Zones are dotted, and the Temperate Zones left white. Owing to the "projection" used, the Torrid Zone, the part near the Equator, appears to be narrower than it really is.

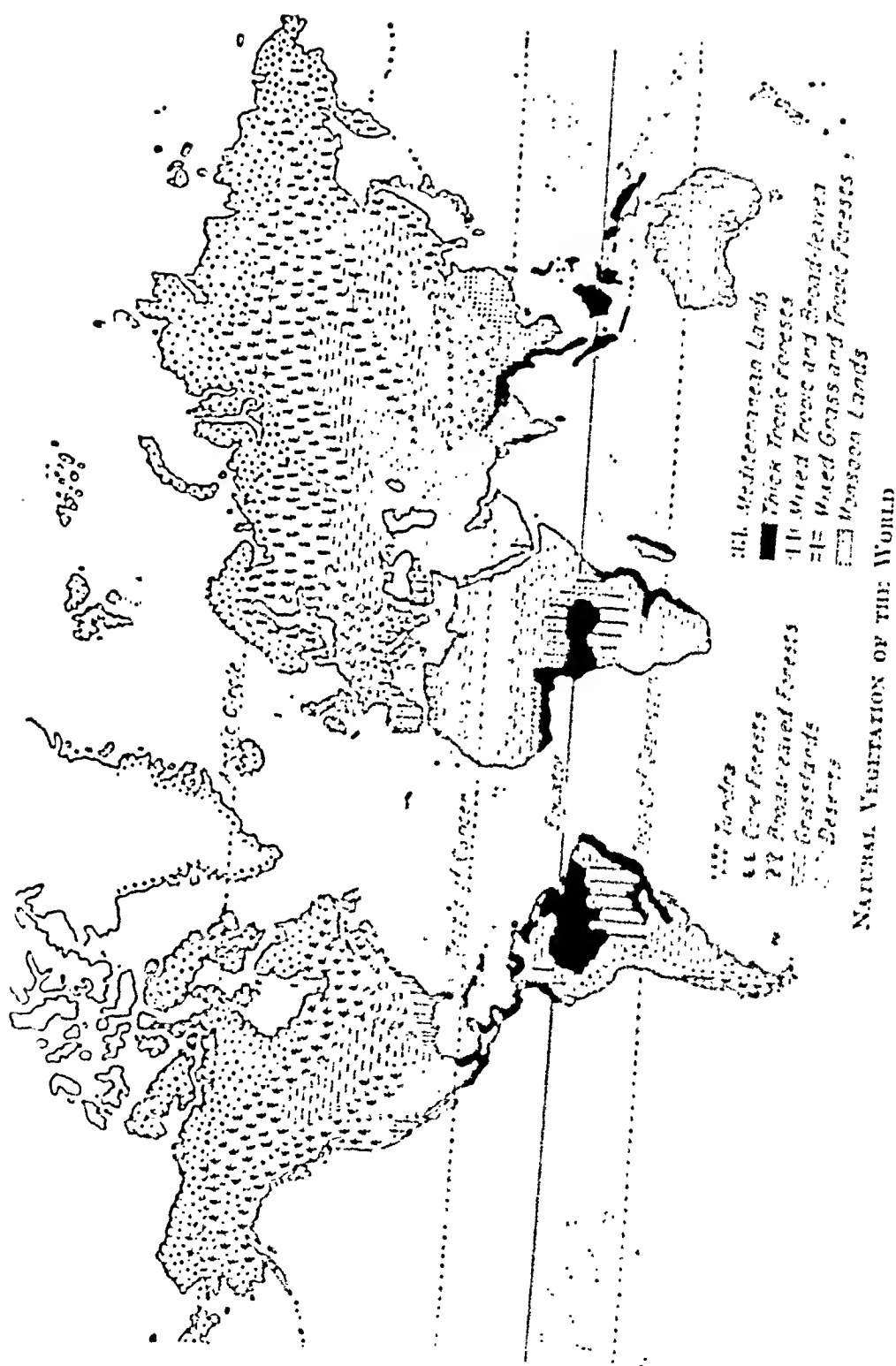
The part of the belt north of the Equator enjoys, or suffers from, great heat during the northern or English summer. The part south of the Equator has the sun overhead at noon some time during the Australian or southern summer. On Midsummer Day of the northern summer the sun shines directly overhead at noon on all places on the Tropic of Cancer, $23\frac{1}{2}^{\circ}$ north of the Equator; on the shortest day, or Midwinter's Day, it is shining over the Tropic of Capricorn, $23\frac{1}{2}^{\circ}$ south of the Equator. All the land between the two Tropics is in the *Torrid Zone*, or hot belt of the earth.

Around each pole there is a cold belt, or *Frigid Zone*. Between the cold belts and the Tropics, or torrid Zones, are intermediate regions, the *Temperate Zones*, where the climate is neither very cold nor very hot.

Temperature, or the degree of heat, does not of itself constitute a good or complete guide to climate; the amount of rain that falls and the time or season when it falls are equally important. The amount and the season of the rainfall on a given tract of land are governed by the position of that land in relation to the sea and the prevailing winds; and both the total amount of the rain that falls and the season of its falling have an influence upon the growth of plants.

There is really but one ocean, one surrounding sea from which the great continents stand up like mighty islands. For convenience, however, this one ocean is divided by geographers into several parts, the Pacific, the Atlantic, the Indian, the Arctic and Antarctic Oceans. Sometimes the waste of waters washing around the frozen shores of the little-known Antarctic lands is spoken of as the Southern Ocean. The Southern Ocean is thus a name for the world-wide spread of sea where the southern ends of the Pacific, Atlantic, and Indian Oceans meet the Antarctic Ocean.

Into the Southern Ocean project the narrow ends of South America and of Africa; and Australia lies along its northern edge. But the great mass of the land surface of the world lies in the northern hemisphere; the southern hemisphere is mainly sea. All North America, all Europe and all the mainland of Asia, with the broad part of Africa, are in the northern half of the world. Moreover, all the broadest parts of the North



American continent, of Europe and of Asia, together with much of Northern Africa, lie so far north as to be in the North Temperate Zone. It may be said, therefore, that the *North Temperate Climatic Belt* is the most important of the five heat belts, or zones, of the World.

Vegetation and Rain Belts. In some lands rains fall all through the year, scarcely a day passing without its shower. This is more particularly true of the lands and seas lying near the Equator. In these equatorial lands, under the combined effects of heat and rain throughout the year, vast forests of hard trees grow.

Northward and southward from the *Equatorial Forest Belt* there are two distinct seasons, one wet, the other dry, but both warm. There trees do not flourish, but tropical grasses grow ten or even twenty feet high.

Beyond the *Tropical Grass Lands* are hot dry lands where the rainfall is almost nil. Thus sandy deserts stretch over large areas lying on or near the Tropics of Cancer and of Capricorn. In the continental interiors, where rain is scarce, dry lands stretch north of Cancer.

Beyond the rainless *Desert Lands* of the tropic edges, there are, on the western sides of the continents in both the northern and southern hemispheres, delightful lands of sunny summers and winter rains where oranges and grapes grow to perfection and olive trees flourish. These are the *Mediterranean Lands* of the world, so named because the largest area of this climatic type lies around the Mediterranean Sea (see map on p. 70).

Eastwards of the hot deserts and of the Mediterranean Lands, where the eastern sides of the continents again reach the ocean, are *Monsoon Lands*. The most notable is in South-eastern Asia. There during the northern summer strong winds blow from over the tropic seas and drench India, Further India and southern China with rains.

In the southern part of the North Temperate Zone, beyond the Mediterranean Lands, rain falls at all seasons near the ocean. There great forests of deciduous trees formerly grew, but now the land is mostly cultivated. Eastward, away from the ocean's modifying influence and the rain brought by westerly winds, the forests give way to grasslands and then even—

particularly in Asia—to *steppe* and semi-desert, changing back, farther east still, to grass again, and then to cultivated lands.

The northern side of the North Temperate Zone is covered with coniferous forest, i.e. with firs and pines, which resist the winter cold and grow in summer. The opposite course is followed by the trees near the hot desert edges. There summer is the resting time and the winter, or cooler season, the growing time.

Northward of the *Coniferous Forest Belt* the land changes gradually into dreary wastes of moss and lichen-covered soil, ending finally in the utter desolation of the Arctic islands of North America, the glacial-ice of the interior of Greenland and the cold, inhospitable shores of Siberia.

In the southern hemisphere the temperate lands are smaller than in the northern, for the African and American continents narrow towards the south. In Australia temperate lands hardly exist at all, but there are regions corresponding to the Mediterranean lands of Europe and their grassy eastern edge. The desolate wastes of the lands around the South Pole, now being explored, seem worse than any in the northern hemisphere. Antarctica appears to be lifeless, destitute even of mosses and lichens.

Summary of Vegetation Belts. The order of the vegetation belts from the North Pole to the Equator is roughly as follows :

- I. ARCTIC :— Frozen Polar wastes
Mosses and lichens
Bushes and dwarf trees.
- II. TEMPERATE :—Coniferous forest lands
Deciduous trees, grass, desert, deciduous trees
Mediterranean lands, desert, Temp. Monsoon lands
Scrub lands, desert, Temp. Monsoon lands.
- III. TROPICAL :— Hot desert, Tropic Monsoon lands
Scrub, Tropic Monsoon lands
Grasslands, Tropic Monsoon lands
Forested Savana, Tropic Monsoon lands
Equatorial forests,

The belts do not change suddenly, but gradually, both from north to south and from east to west, varying with the temperature and rainfall. Under 5 inches of rain in temperate lands means temperate desert, but 15 inches are needed in tropic lands for good grass. Under 15 inches in tropic lands means desert conditions.

Belts and Characteristics. A rough idea of the changes in temperature and in rainfall of the various belts is given in the following table :

	SUMMER TEMP.	WINTER TEMP.	RAINFALL	PLACE
EQUATORIAL FOREST .	80° +	76°	100" +	Amazon (Para)
TROPIC FOREST .	79° +	65°	80" +	Rio de Janeiro
TROPIC MONSOON .	82° +	75°	75"	Bombay
HOT DESERT .	96° +	56°	5"	Khartoum
MEDITERRANEAN .	76° +	52°	30"	Algiers
DECIDUOUS FOREST .	60° +	38°	25"	London
CONIFEROUS FOREST .	58° +	20°	21"	N. Sweden
ARCTIC TUNDRA .	40° + to 60° +	Below Zero	10" to 15"	

The temperatures and rainfall are averages ; on any given day they may be less, or more. Rainfall in some monsoon districts may be as much as 600 inches. The fall at Bombay is about 72 inches for the wet season ; the remaining 3 inches falls during the other nine months. At Algiers over 20 inches out of the 30 inches falls in the winter.

EXERCISES

1. Why are all men really interested in agriculture even if they do not think much about it and earn their living in other ways ?
2. Write a short account as to the ways in which plants derive their food from their surroundings.
3. Make a diagram showing the comparative temperatures of the places mentioned in the table above.
4. Make a diagram showing, graphically, the rainfall at those places.

IV. TEMPERATE BREAD-LANDS

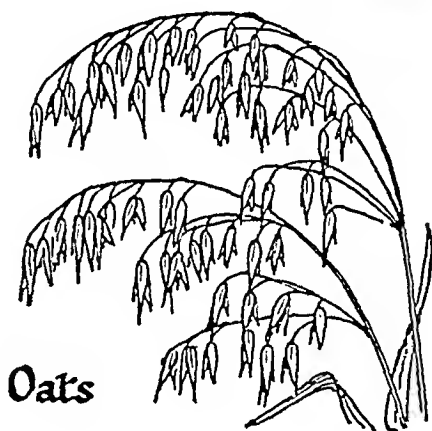
Long, long ago the men of the civilized races living on the sunny shores of the Mediterranean Sea knew how to grow and cultivate corn. Seeds of wheat and barley have been found embedded in the debris of forgotten lake-villages in Switzerland ; and in the tombs of Pharaohs, dead fully six thousand

Wheat



Barley

Rye

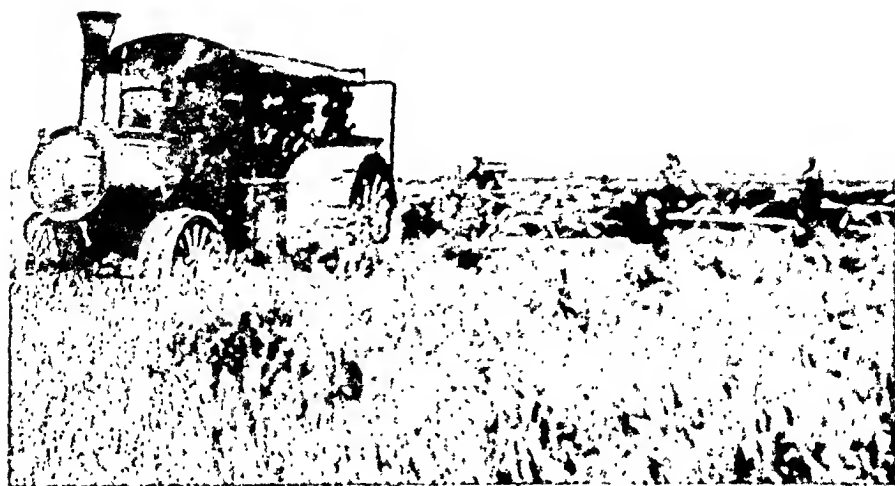


Oats

CEREALS OF TEMPERATE CLIMES

Wheat. Bread is the main cereal food of the white race, and of the English-speaking part of it in particular. Bread is made from the flour of wheat, the typical grain of temperate lands. From it alone can bread, in the modern sense, be made. Oatmeal-cakes and barley-bread, the black rye-bread still used in northern Europe, may have been good enough for our ancestors. In the 18th century, however, the Englishman "lost his rye-teeth," and began to clamour for the light, spongy, white-coloured loaf made from dry, hard wheat, without its outer covering of bran.

To satisfy this demand fleets of great steamers now cross the seas, heavily laden trains are dragged across the prairies of



MODERN METHODS OF REAPING
in Alberta, one of the great wheat-growing provinces of Canada.

North and South America, and lands once given up to the Indian and the buffalo are smiling fields of corn. Even the snow-covered winter wastes stretching northwards and westwards to the forest region of pine and fir are being made, in the brief warm summer of long sunny days and short nights, to provide new cornlands for the peoples of western Europe; and farmers are developing new forms of wheat which will grow and ripen before autumn frosts usher in the cold of a six months' winter.

Wheat, being a grass, needs moisture to make its plant grow, more moisture, but not too much to swell its kernels when the grain forms in the ear, and then dry, warm, sunny weather to harden and ripen the grain. It also needs a good soil near the surface, with an admixture of clay beneath; the moisture-holding clay feeds the grain after the main rush of plant-growth is over. Light sandy soils, and soils with too much chalk, are not good for wheat; the straw produced is too short and the wheat-grains are too few and meagre.

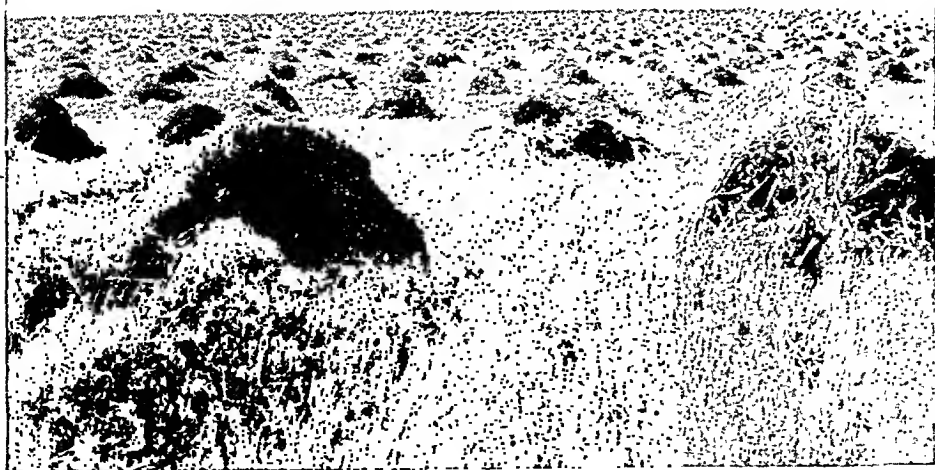
The northern limit of growth is roughly parallel with the July, or midsummer, isotherm of 60° . The great length of the summer days in far northern lands tends to compensate for a

smaller number of days with the proper ripening temperature. This is a day temperature of about 60° for a period of three months.

A rainfall of from 15 to 35 inches a year is suitable. Winter snows compensate to some extent for lack of rainfall when seed is spring sown. It is this which makes the Canadian northern prairies suitable for wheat. There the melting snows, disappearing under the mellowing influence of the Chinook winds, provide the necessary moisture for the plant; and the light spring rains which follow further encourage growth.

The ripening time should be sunny and bright. Dry weather and a sun shining from out a blue sky are necessary for wheat in summer, as well as warmth. Wet, moist heat, such as that of tropic lowlands, or even of a warm, temperate climate, brings in its train rust and mildew. Lands of warm, wet, "milch" weather, with cloudy skies and summer rain, are ruin for wheat, even if the cloudy spells are interspersed with periods of bright sunshine.

In temperate northern climes two main groups of wheat have been evolved, one suitable for winter sowing, and the other for spring sowing. The winter wheat is sown in autumn,



[Photos : C.P. Railway.]

WHEAT FOR EUROPEAN MARKETS

A view of the field on the opposite page—after the reapers have done their work.

soon after the previous harvest ; and the plant is not damaged by mild frosts such as those experienced in East Anglia. Falls of snow help to protect it from too severe cold. Spring wheat is sown after the colds and snows of winter are departed. Usually it is ready for harvest at the same time as the winter wheats. The prairies of Canada and of the northern parts of the United States of America grow spring-sown wheats ; East Anglia mainly grows winter-sown wheats.

Study of wheat varieties and of climates has made the growing of wheat possible in the drier, semi-tropic lands where wet and dry seasons alternate. Thus in the dry Indus basin wheat is grown as a winter crop. It is sown soon after the rains, when the ground is warm and wet ; and, growing during the so-called cool season, it ripens rapidly before the hot season begins.

The main Indian wheat area lies outside the tropics. Some wheat, however, is grown on the high lands of the Deccan, behind Bombay, which form part of tropical India.

It is the flooding of the Nile valley which has made wheat-growing possible in Egypt. In the drier lands of California, and even of the Great Basin and of the Rocky Mountain intermontane plateaus generally, good wheat lands can be formed out of parched high plains by irrigation. Wheat will grow if the moisture reaches its roots ; it is not necessary for the water it needs to fall as rain. With dry farming methods as little as 8 inches of rainfall is sufficient.

European Wheat. The countries of Europe taken together still grow more wheat than those newer lands of America, where wheat cultivation greatly increased at the end of the 19th century. They also eat more. Western Europe consumes more than half the wheat grown in the world.

The southern and eastern side of England is good for wheat. Ireland is too wet, and Scotland generally too cold. France has a great proportion of its land under wheat, but nowadays the yield is not very good and wheat has to be imported. Spain and Italy grow hard, dry wheats. The Italian crops are used in making *macaroni* and *vermicelli*.

The black lands of southern Russia are admirably suited for wheat growing. The whole of the plain which extends from

northern Rumania, through Russia, to the heart of Siberia, in Asia, will grow spring wheats. Towards their south-eastern side the Russian black lands reach the steppe and semi-desert of the Caspian; even there modern methods of dry farming are resulting in more land being given year by year to wheat.

In Czarist days Odessa was the great wheat-exporting port of southern Russia. A fifth of the world's wheat was then grown in Russian lands. After years of disorganization and revolution, the importance of the wheat trade is now reviving under the rule of the Union of Socialist Soviet Republics.

In central Europe, where the River Danube runs sluggishly over the great Hungarian plain, some of the best wheats of the world are grown. Hungarian wheat and Hungarian flour are noted for their dryness, hardness, and whiteness.

Hungarian and Russian wheat is grown largely for export. The peasants and working people of south-eastern Europe mostly eat maize, which is cheaper than wheat; while towards the northern side of the U.S.S.R. wheat lands the main bread-food of the people is made of rye.

American Wheat. The early white settlers in America took with them from Europe their love of wheaten bread, a thing not known to the Red Indians, whose cereal food was maize. On the Atlantic shores of New England wheat can be grown, but not without difficulty. It was only when railways made transport possible over the great distances of the prairie that the American continent became one of the chief granaries of the world.

Northward from the prairie the wheat area reaches to the cold lands of the Arctic and sub-Arctic forests. In the northern section, which stretches southward from Canada into the United States, down into North Dakota and the Red River Basin, spring wheats are grown. Across the Central States winter wheat is cultivated, though in some parts the alternation of sharp frosts and sudden thaws is too much for the plants, which are squeezed up and out of the soil.

The bulk of the wheat of Canada is spring wheat, and well over 90 per cent. of the whole Canadian crop is grown in the three provinces of Manitoba, Saskatchewan and Alberta. Wheat has made Winnipeg, the capital of Manitoba, grow,

in half a century, from a trapping and fur-trading centre of a few hundred people, into a fine city which, with its suburbs, has a population of nearly 250,000.

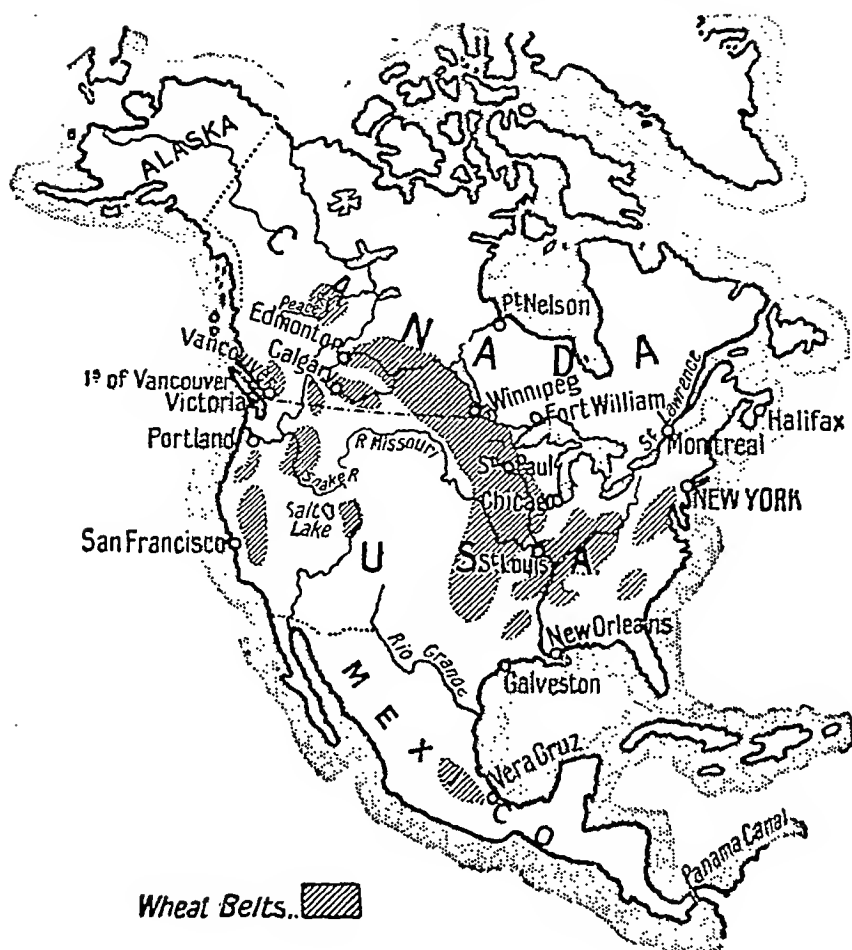
In the drier lands of the western prairies, where the rainfall varies from 10 inches a year to only 5 inches, in the upper valley of the Snake River of Oregon and Washington beyond the Rocky Mountains, in the mountain-ringed plateau of the Great Basin, and in the valley of California, wheat is grown by dry-farming methods on irrigated lands.

In the higher parts of the Great Basin, near the Great Salt Lake, the melting snows of winter provide the necessary moisture; often no rain falls on the growing wheat. There are grown forms of wheat that, when ripe, will hold the kernels in the ear. Thus a few harvesters can leisurely reap the corn, spending a month or so over the task. In those dry, sunny lands there is no fear of autumn rains ruining the ripened, standing grain, as so often happens in England.

Southward in America, beyond the Tropics—beyond the fabled realms where in old times the mariners of Europe dared not venture for fear they should be scorched to blackamoors—lies Argentina, another wide-spreading prairie region which science and farming skill have made into a vast granary.

Two great rivers, the Paraná and the Paraguay, flow from the tropic highlands of Brazil, and, joining, enter the South Atlantic Ocean as one river through the noble estuary of the Rio de la Plata. From the head of this estuary there spreads out, fan-shaped, for three or four hundred miles, a fertile alluvial plain with a warm and equable temperate climate, and a rainfall of about 20 inches a year. This plain was once covered with pampas grass, and, for two or three centuries after the Spanish occupation, half-breed gauchos herded and chased half-wild, badly-reared cattle on it. Now over 20 million acres are given to growing wheat, and Argentina ranks, next to Canada, as the second wheat-exporting country of the world. In good years Buenos Aires and other ports on the La Plata estuary send to Great Britain some 3 or 4 million tons of wheat, worth about £10 million.

Asiatic Wheat Lands. In the north of Asia are large areas of good soil where hardy, quick-ripening wheats may



NORTH AMERICAN WHEAT-LANDS

be grown. Some day, perhaps, these Siberian wheat lands will rival those of Canada. At present the chief drawback is the difficulty of transport.

Like the River Mackenzie in Canada, the Siberian rivers run to the frozen north. But in Siberia there is no great outlet, such as the St. Lawrence, to give a chance for transport by water through more genial regions. Efforts, therefore, are being made to rush steamers through the Arctic Seas to the mouths of the Ob and other rivers in the three months of the year during which those rivers are not frozen.

The wheat lands of India lie mainly in the north-west in the Indus basin, where, in the late 19th and 20th centuries, irrigated farm lands as large as the whole of England and Wales

have been brought under cultivation. The wheat is grown as a winter crop, and is different in character from the wheats of England, which will not do well in India. Most of it is exported from Karachi at the Indus mouth.

In China and Japan, away from the wet monsoon lands and the warm, hilly regions adjoining, more and more wheat is being grown and eaten, but, owing to the dense populations of those lands, there is no surplus for export. Where the population is scanty, the soil is poor or semi-desert, though nowadays, in Manchuria, hard-working Chinese emigrants from farther south are making the dry lands produce good crops.

Australian and South African Wheat. Australia is largely tropical, and also arid, but there are regions suitable for growing hard white wheats in the south, where Mediterranean conditions prevail. In South Australia and in parts of New South Wales and Victoria, many acres are devoted to wheat, and some is grown in the south-western corner of Western Australia. The crops are thin compared with those of East Anglia, but the quality is good and the cost of growing, owing to the cheapness of land, is very much less.

The quantity of wheat grown in South Africa is not large. Weather conditions in the districts where white men can live are more suited to the cultivation of maize and millet. Such wheat as is grown is consumed locally.

Wheat Harvests of the World. There is now little fear of the "starving month of May" in England. Owing to the different times of harvest in various parts of the world, there is no month of the year in which wheat is not harvested somewhere.

The chief harvests are as follows:

JANUARY: Australia, Argentina, New Zealand, Chile.

FEBRUARY: India.

MARCH: India, Upper Egypt.

APRIL: Mexico, Lower Egypt.

MAY: North Africa, Texas, China.

JUNE: Southern Europe, California, Oregon.

JULY: France, Hungary, South Russia, Northern U.S.A.

AUGUST : England, Belgium, Holland, Germany.

SEPTEMBER : Scotland, Sweden, Russia.

OCTOBER : Finland, North Russia.

NOVEMBER : South Africa, Peru.

DECEMBER : South Australia, Burma.

The principal wheat *exporting* countries are :

Canada = 25 million quarters.¹

Argentina = 15 " "

U.S.A. = 14 " "

Australia = 10 " "

India = $\frac{1}{2}$ " "

Hungary = $\frac{1}{4}$ " "

The principal wheat *importing* countries are :

Great Britain = 24 million quarters.

Italy = 12 " "

Germany = 6 " "

France = 5 " "

Belgium = 4 " "

Japan = 1 " "

Barley. Perhaps the hardiest of the cereals and the oldest of the bread-foods is barley. This will grow not only wherever wheat will grow, but in regions not suited to wheat. It ripens quickly and so can be found well within the Arctic Circle, high up on mountain sides, and in oases of the Sahara Desert. Barley gives a heavier crop than wheat, but does not bear well with too much moisture.

Barley cakes were common in Scotland within fairly recent times ; and they are still a popular food in parts of Japan, India and North Africa, and in much of Scandinavia.

The barley grown in the drier and warmer parts of England and of Europe is used largely for brewing beer ; and the beer-drinking countries are those which import it most freely. England heads the list, though much of the imported, as well as of the home-grown, barley is used for feeding pigs.

¹ The figures are only approximate, for each harvest varies. A quarter of wheat is two sacks, or eight bushels. A bushel of wheat is reckoned to weigh about 60 pounds. A sack of wheat is about 18 stone.

Oats. The damper climates of the wheat belt are best suited for oats. Dry and arid wheat lands, like India, are not suitable; nor are the edges of the Sahara, where barley thrives. In the moist climate of Newfoundland oats do well, though other cereals will not grow.

Oats are chiefly used in England as horse-corn. Much of the Scottish crop is eaten as porridge and oatmeal cakes. In the U.S.A., too, a great deal is consumed as a breakfast food.

The U.S.A. and Russia are the chief oat-growing lands. But all around the Baltic Sea, where the soil is poor and sandy and the climate too damp for wheat, there are large areas under oats.

Great Britain is the chief importer of oats; Argentina and Russia are the chief exporters.

The oat kernel does not swell like wheat when damped. Thus horses can eat it freely. A meal of wheat, owing to the expansion of the grain, would be death to them.

Rye. Though, when growing, it is very much like barley in appearance, rye is really a humble relation of wheat. It grows on poor soils and will ripen in wet summers, but it does best in conditions favourable for wheat. Its straw is stronger than wheat straw, and so can hold up its head to catch the drying breezes when very damp conditions lay wheat flat on the ground.

East of the Rhine and north of the Alps, rye-bread is the chief food of the peasantry of Europe. It is very nutritious, and some people like it, but it is heavy and sour and dark in colour. Vodka (a Russian drink) and rye-whisky are prepared from rye. Much rye is now grown in the U.S.A. and in Canada owing to the influx, during the 19th century, of peasants from northern and central Europe.

EXERCISES

1. Why are certain food grains called cereals? Name the chief of them.
2. Draw a map to show the chief wheat-growing regions of the world.
3. Draw another map to show where rice is largely grown.
4. What are the chief differences between a "wheat climate" and a "rice climate"?
5. Make a diagram showing graphically the chief wheat-exporting countries of the world.
6. Why is more rye grown in Baltic Lands than in Great Britain?

V. RICE

Rice is the cereal food of the tropics and of the warm temperate lands with a heavy summer rainfall. What wheat is to the peoples of temperate lands, rice is to those of the tropical lowlands. To a quarter of the world's population it is the mainstay of life.

Wheat and rice do not thrive in the same lands, for wheat needs dry, sunny summers and rice must have summers which are warm and moist. Winter crops of wheat, however, are sometimes harvested in a few rice-growing districts of China, Japan and India before the summer rains set in. Such double crops make it necessary for the rice plants to be transplanted, partly grown, from a seed-bed.

Rice is Asia's great food gift to a famine-fearing world, for, though most of what is grown is eaten locally, only 5 per cent. entering into the commerce of the world, its dry kernels and close-fitting husk make it possible for the grain to be transported and stored in any climate, from steaming equatorial regions to the frozen poles.

Rice does not make good bread, for it has not the spongy nature of the wheat gluten; but to boil it is much easier than to bake bread from wheat flour. The peoples of the East boil it, and flavour it with curry, or hot, biting preparations of some kind.

Rice contains much starch, and so serves as a substitute for the bread and potatoes of the West. In some parts of the newer rice-eating countries peas and beans are used to supply the lack of meat, milk and cheese. Pulse also is used to eke out the starchy rice diet of the East.

The rice seen in Western shops is shiny, white and polished. In the East rice is eaten with the bran; only the rough outer husk is taken off.

Rice with the first outer covering still on is called *paddy*. The outer husk of the paddy is not removed until the grain is actually needed; the "braying" or pounding of the paddy with a heavy mallet to loosen the husk is one of the most common sounds in monsoon lands.

The bran is sent to Europe as cattle food. The straw is

used for making paper, hats, sandals, mats, etc., also as fodder for working animals.

Rice Growing. There are many hundred varieties of rice, but all may be classed, roughly, into two main kinds: the rice of the wet lowlands, and upland rice. Lowland rice is the more prolific and is more commonly grown; it is a safe and certain crop suited for cultivation in densely-peopled lands. The upland rice is an uncertain crop; it needs half an inch of rain a day to make it grow really well.

The rice of the monsoon lands of India and South-western Asia is sown under water; and the young plants must be kept flooded for the first few weeks, but the water in which they stand should not be allowed to become stagnant. On the flat fields of the great river deltas and alluvial plains of Asia the crops are alternately flooded and drained of water. The water is drained off altogether as the kernel ripens.

The hill-sides of many parts of Asia are terraced to get the flat fields necessary. Ceylon and Java show wonderfully terraced hills where low walls support the soil; often each terrace is only a few feet wide and all the work of sowing, cultivating and harvesting is done by hand. On the wider, level fields of the deltas and plains slow-moving water buffaloes drag clumsy wooden ploughs over the sodden fields before the young plants are transplanted by hand from the seed-beds to the real crop-fields.

When the water supply and the temperature are sufficient, the growth of the rice plant is very rapid; sometimes it is as much as six or more inches a day. Since a temperature of 80° is needed for ripening, the crop is rarely successful unless grown on the warmer side of the July isotherm of 75° . A minimum of 40 inches of rain is necessary where the fields are not irrigated, but for a really good crop a fall of 80 inches is wanted during the growing season.

These conditions are fulfilled in the wet coastal lands where the Asiatic monsoon pours a drenching summer rainfall—in India, Burma, Siam, southern China, and southern Japan as far as latitude 51° north. Yet even the monsoon rains are not sufficient for many of the rice-fields. More than half of the rice-growing arable land of Japan is irrigated; and much of



[Photo : W. Robert Moore.]

RICE CULTIVATION IN JAVA

The fields are alternately flooded (*top*) and drained of water, the ploughing (*bottom*) being usually done by means of slow-moving water buffaloes.

the water has to be lifted, by waterwheels, or by hand-buckets, from the lower terraces to the higher levels.

Newer Rice Lands. Rice growing is on the increase outside the Asiatic monsoon lands.

The need of labour on the sugar-fields of the tropical lowlands of America, particularly of British Guiana, led to the introduction of Indian coolies. This, in turn, led to a demand for rice to feed the new workers; and there, near the shore, along the swampy levels formed by the tide wash from the Amazon, are warm, wet stretches of alluvial plain which, when banked in from the sea, are well suited for rice cultivation. Much rice also is now grown in the larger West Indian islands; and Brazil of late years has begun to export it. Around the Gulf of Mexico, too, on each side of the Mississippi delta, the climatic and soil conditions are good for rice. Indeed, some of the warmest, wettest and lowest parts of the Mississippi and Gulf plains are now being made to grow the tropic Asiatic cereal under novel modern American methods.

Ten million acres around the Gulf are said to be suited for rice. Wells are dug to supply the necessary water; and pumps are erected to force it over the fields, and dykes to hold it up. These dykes are set at such wide intervals that the land can be ploughed and harrowed, and the rice harvested, by machines similar to those used in cultivating wheat. Much of the rice grown on the Gulf plains is moved north to the millions of negroes who work on the American cotton plantations.

The Rice Trade. Figures relating to the world-trade in rice are deceptive. They show only a very small part of the crop, since most of the rice which is grown is eaten on the spot. China, so far from having any to spare, actually imports. India grows over 40 million tons but eats nearly all of it.

Half of India grows none at all, for the rainfall is under 40 inches a year. In such parts millet is the staple food.

Rice shown as exported from India really is exported from Burma. There the Irawadi valley is wet enough, and low enough, to produce more than the population needs. Rangoon is the port from which it is sent. Siam and French Indo-China also have a surplus for export.

Japan imports from the Korea; and the rich tropic island of Java, though rice is grown there in very large quantities, has such a teeming population that it also needs to import. Ceylon and the Philippines, notwithstanding their many terraced hills, have little rice to spare.

Egypt can grow good rice where the Nile floods spread their water and fertilizing mud, but there is none to spare. Spain and Portugal grow some, and occasionally have small quantities to export. The valley of the Po, in northern Italy, has nearly half a million acres irrigated for rice-growing; most of the rice exported from the Mediterranean lands is produced there.

There is a considerable trade in rice between California and the other parts of the U.S.A. California has a Mediterranean climate, and, as in the Po valley, the snow-covered mountains surrounding the warm summer plains supply copious streams from which the fields can be irrigated, thus making it possible to grow what is a tropic crop in a warm temperate land.

It has been estimated that the export trade in rice amounts to something over 5 million tons. About $2\frac{1}{2}$ million are sent from Burma and India; about 1 million from Siam; and about 1 million from French Indo-China. The rest comes from Italy and the U.S.A. Nearly all other countries import rice, in larger or smaller quantities.

EXERCISES

1. Why are monsoon lands suitable for farming and food growing?
2. Describe a year's work, from ploughing to harvest, in a rice-field.
3. Why are rice-fields irrigated?
4. Why do China and Japan have to import rice?
5. Why is rice now grown in British Guiana and around the Gulf of Mexico in the U.S.A.?

VI. MAIZE AND MILLET

Maize, or Indian corn, ranks next to wheat and rice as the third great bread-food of the world. It was unknown to Western Europe before the time of Columbus; but it was a common food crop in Aztec Mexico and, in the ages before white domination of North America, its use had spread far and wide among the less civilized Indians of the plains.

These people knew of five main varieties of maize, each of which had many sub-divisions, and they had learnt to grow the kind most suitable to climatic conditions. Thus, in olden days, maize crops were grown and ripened where modern varieties languish and die out, or are never tried.

The stony soils of New England are unsuited to wheat and the small temperate cereals. The land needed for the profitable cultivation of these crops must be fairly level and unencumbered by rocks; and it must not be thickly forested, as was much of New England in the days of the Pilgrim Fathers. The Indians showed the colonists how to kill the trees by ringing the bark, and then how to drop the seeds between the stumps. This method ensured a good crop which was ready in June or July, long before wheat would have been ripe for harvesting.

The kernels of maize can be, and are, eaten as a vegetable before they are ripe, in much the same way that peas are eaten in England.

Maize Cultivation. The maize plant grows from six to eighteen feet in height, and the space left between the plants is greater than between the cereals of Europe. Thus rocky soil and trees do not matter to the single plants if the roots can get down into the rich soil below. For this reason maize is still cultivated largely in the rougher Appalachian lands of the U.S.A., but it is easier to cultivate where the soil is more level and free from surface lumber of stone, tree and bush.

The soil should be deep and deeply ploughed, a well-mixed loam, not too stiff with clay and not too dry with sand; maize does not do well either in a sodden soil, or in an arid subsoil of chalk, lime or sand. The weather should be warm and sunny, with frequent showers but not too heavy rains.

Frost is fatal to growth. A summer of from $4\frac{1}{2}$ to 7 months, therefore, is required, with warm nights as well as warm and sunny days. Such summer weather is usually found at sea level between 40° and 45° north or south latitude, where in-blowing breezes from a warmer sea bring almost daily rains, and the average temperature for a month or so is over 65° .

These conditions are found almost at their best in the eastern half of the United States. The wide-spreading prairies of the middle Mississippi valley are ideal for maize.



CROPS OF THE MISSISSIPPI VALLEY

The corn belt of the U.S.A. finishes, except on irrigated lands, where the rainfall of the summer months falls below 8 inches. Farther south, along the wetter, warmer lower levels lying around the Mississippi delta and the Gulf of Mexico, corn does not do well; the conditions are too tropical. Thus maize is the bread-food of sub-tropical lands, too warm and wet for wheat, but not warm and wet enough for rice. It will not ripen in the colder wheat lands, and in the warm, wet tropics it runs to foliage and stalk.

Maize as Food. In England a farmer talking of "corn" generally means wheat. Sometimes he may mean oats and barley; and a farm-labourer may even be heard speaking of beans as "hoss-corn." In the U.S.A. wheat is always referred to as wheat; "Corn" means Indian corn, or maize.

There is twice as much land given up to growing corn in the States as there is to growing wheat, so that by "corn" is meant the most important cereal. The largest part of the crop grown in the corn belt of the States is fed to pigs and cattle.

Maize does not make good bread. Owing to lack of gluten, the spongy, "rising" qualities belonging to dough made from wheaten flour are wanting. But though, when cold, it is sad, heavy and unpalatable, maize bread is very nutritious. In Mexico and in the Spanish-American republics of South America lying in and near the tropics (Brazil, Venezuela, Peru, Ecuador and Colombia), it is eaten warm as *tortillas*, or flat cakes, served with a dish of stewed beans.

"Parched" corn consists of the cracked kernels of the maize plant heated in a frying-pan. Maize-meal or "mush" is the whole kernel ground into a coarse meal; "hominy" puddings are made from it in the U.S.A., and in Italy it is eaten as a kind of porridge called *polenta*. Cornflour is the flour obtained by grinding the kernel without the husk, or outside covering.

Cornflour is the only form in which maize is used to any extent as human food in England.

The soft kernels in their milky, unripened state are taken from the corn-cob and eaten as a vegetable in the U.S.A. Much corn is "canned" in this form and sent to the large



MAIZE OR INDIAN CORN

is grown mostly in the U.S.A. where 70 per cent. of the world's supply is produced, but it is being cultivated more and more in other parts of the world ; here a South African field is seen. As a human food maize is best known in England in the form of cornflour.

industrial cities, the leafage and stalks left behind being used for feeding stock on the farms where the corn is grown.

Various kinds of beer, and much whisky of a kind, were at one time made from maize in the States. To some extent maize is used in brewing English beer.

The negro of the cotton-lands of the States may live on "corn," but the farmer of the corn-belt feeds it to his hogs. It is the food basis of the great packing industry of Chicago, of St. Louis, of Omaha and the other great towns of the Mississippi States. Millions of hogs are reared, sent to Chicago, slaughtered and made into bacon. Hogs fatten quickly on a diet of mixed corn, of corn-silage, and of molasses.

Corn-silage is a comparatively modern invention in America. The whole plant is cut, stalk, leaves, cobs, kernel and all, chopped and stored in big barrel-like structures, called *silos*. There it will keep fresh and good for one, two or three years.

Nearly every big farm in the corn-belt has its silo. This use of corn makes its growth possible north of the true weather range, for the plant is cut before the kernels are ripe.

Maize Lands and Export. Besides the corn-belt of the U.S.A. and the plateau lands of the tropical Spanish-American republics, there is a wide region in Argentina, in the Parana basin, suitable for corn. This region, being but sparsely populated, has a great export compared with its total crop.

The U.S.A., which grows some 70 or 80 million tons out of a world production of about 100 million tons, exports only 2 million tons a year. The rest is consumed locally, or exported, as it is often said, in the form of bacon and tinned beef.

In Europe, there is a rich corn-belt in the Danube basin and around the Black Sea, but towards the eastern side of the Black Sea the climate becomes too dry. Hungary, Rumania, Yugoslavia and northern Italy grow considerable quantities

for home consumption, but the strictly Mediterranean lands are too dry in summer, without some form of irrigation. Rumania and Hungary export about a million tons a year.

Maize is grown in Egypt, in South Africa and Rhodesia. Some is grown in Australia, on the eastern coasts of Queensland and New South Wales. In Asia the growth of maize proper is spreading on the Gangetic plain, as an alternative crop to



CEREALS OF DRY, STONY LANDS

rice or winter wheat, and in the non-rice districts of northern and central China.

Of the total world crop of 100 million tons, some 6 or 7 millions are exported—3 million tons from Argentina, 2 million from the U.S.A., and 1 million from Rumania and Hungary. Formerly Russia exported more than half a million tons.

Millet Cultivation. Millet is a corn somewhat resembling maize, but the kernels are smaller. It has been grown for many centuries in the drier, hilly districts of Africa and of south-eastern and central Asia. The varieties are many and the names given to them vary from *sorghum* to *dhurra* or *darra*, and Kafir corn. The millets proper have heads something like "cat tails" in appearance; the sorghums are something like bells of oats with heavier kernels.

Millets are especially valuable to the hill populations of India and of northern and central China. Many of the people of those parts rarely eat rice, and before the days of railways had never seen it. There are records of the use of millet in China going back for 5,000 years.

The lake dwellers of Switzerland had a corn like millet.

Little millet is exported, though it has been said that a third of the human race lives mainly on it.

EXERCISES

1. Why are certain parts of the U.S.A. called corn-lands, others wheat-lands, and others cotton-lands?
2. Draw a map to show the chief maize parts of the States.
3. Why are so many hogs fattened in the corn-lands of the States?
4. What sort of weather is best suited for maize growing?
5. Why can maize be grown more easily than wheat among tree-stumps and in rocky soils?

VII. VEGETABLE FOOD-STUFFS OF TEMPERATE LANDS

The cereals—wheat, barley, oats and rye in temperate climates, and rice, maize and millet in warmer or tropical lands—are of vegetable origin, but, providing as they do the "bread of life," they stand in a class by themselves. Other vegetable food-stuffs, such as the potato and the green veget-

ables of the garden; carrots, turnips and similar roots; peas and beans; the sago palm and banana of tropic lands, may be fairly regarded as being used in place of bread and meat by such peoples as cannot get sufficient cereal or meat foods.

Bread made from the cereal grains provides the starch which is needed to keep the human body warm and vigorous. Meat supplies the protein for muscle making. There is protein, as well as starch, in all the grains—particularly in wheat, but meat provides it in an appetizing form. Some of the bread substitutes—the potato, for example—are rich in starch; others, such as peas and beans, are richer in protein.

The Potato. The most valuable of the vegetable food-stuffs is the potato. In temperate lands, which have cool and moist summers, it produces from five to ten times the crop that wheat will give. Moreover, it will yield good crops on light, sandy soils, where wheat would fail and even rye would be poor. Weight for weight, or bushel for bushel, it is not nearly so good a food as wheat, but this is a consideration which the size of the crop overrules in thickly populated lands.

Its value as a starch food in cold climates is enhanced by its wide climatic range. It can be grown in lands as widely different as Alaska and Florida or Egypt, though in the dry summers of Mediterranean lands it loses much of its vigour and good cropping powers. It will grow farther north even than barley, and flourishes in any soils other than heavy clays. Cool, moist summer conditions suit it best.

In warm, wet, tropic lowlands it is commonly replaced by its cousin, the sweet potato.

The potato is an American plant. It originally grew wild on the high, cool plateaus of Mexico and of Peru and Bolivia. From there it was taken to Spain and, later, to Italy and Austria, whence its cultivation spread over the great plain of northern Europe and to the cool lands of Scandinavia. Sir Walter Raleigh is said to have brought it to England and Ireland, but it was probably the *ba ta ta*, or sweet potato, which he introduced. The potato is now also cultivated carefully in northern and central China, on the cooler mountain lands; in the rice-growing parts it is not in favour, nor is the climate really suitable.

The principal potato lands of the present day are the low, sandy, windswept plains of northern Europe from the Atlantic coast of northern France to the Ural Mountains on European Russia's eastern flank. In western Ireland it was for many years the main food of the struggling peasants, who eked it out with milk and pig-fat, or lard.

Germany is now the chief potato-growing country. Poland comes next. Much of the German crop is fed to pigs and cattle; and many thousands of tons of a big, flavourless variety are used in distilling potato spirit. The residue after distillation is fed to the beasts. It is curious that 90 per cent. of the world's crop should be grown in Europe, seeing that America is the potato's natural home.

Good crops are grown in the New England States of America and in Eastern Canada, and are sent in to the large industrial towns near. Maize lands are generally too warm and wet for potatoes, though early potatoes can be grown and then the maize planted.

Foreign trade in potatoes is not large compared with the bulk grown. The greater part of the world trade is done in early potatoes which are sent from lands with a warmer, earlier spring to colder and richer, or more northerly, lands. Thus Algeria sends early potatoes to Marseilles for distribution throughout France. Great Britain imports some £4 million worth of early potatoes a year; they come from the Canary Isles, Egypt, Italy, Spain, France, and the Channel Islands, and, later, from the Netherlands, in a kind of spring rotation.

Germany is now making a kind of flour from potatoes, as well as starch.

The bulk of the potato, compared with its money value, makes transport difficult and costly. Moreover, though easy to grow, the vegetable is very liable to disease. Thus great care is necessary in the choice of seed.

Garden Truck. An expressive term, garden truck, is much used in America for the vegetable crops grown in gardens and other comparatively small spaces. This garden truck is a valuable source of food—and of profit to the grower where transport facilities are good and a rich market is within easy reach. Great Britain imports £10 to £15 million pounds

worth a year. The green leaves are the chief source of the little-known but much-needed *vitamins*.

When English gardens are bare in winter and early spring, tons of onions and green vegetables—cauliflowers, sprouts and lettuces—are sent in from warmer lands, from Italy, France and Spain, and even from Egypt. Onions are brought mostly from Spain and Brittany; and tomatoes from French hot-houses are as great a trade as early potatoes. Pickled vegetables, from Holland, also are a large import.

A similar south to north trade in garden truck, and in early fruits, is very noticeable in spring from Florida northwards to New York.

Pulse. In the days before potatoes were widely grown, "pulse" was an important food crop in Great Britain. Peas and beans are the chief pulses of temperate lands, though "pulse" may mean anything which produces its seeds in a seed-pod—e.g. the fruit of the carob, or locust-bean, found on trees around the Mediterranean, particularly in Cyprus.

Carob seed-pods are sent in large quantities from Cyprus to be used as cattle fodder. An American tree produces a seed-pod something like the locust bean but over two feet long.

The pulses are important because of their power of taking free nitrogen from the air and storing it both in their seeds and in the ground. On the roots of the pulses, when growing, there develops a kind of bacteria, microscopic organisms which extract the nitrogen from the air. These minute organisms enable the pulses to grow in poor soil and to leave it richer in nitrogen. Thus the next corn crop raised profits by the land having grown a crop of peas or beans the year before.

As human or animal food the pulses also are valuable on account of their richness in nitrogenous matter. This makes them a substitute in some degree for meat, since nitrogenous matter is rich in protein, the muscle-building food. Rich nations get protein as meat, but poorer peoples must make shift with the pulses, or *légumes*.

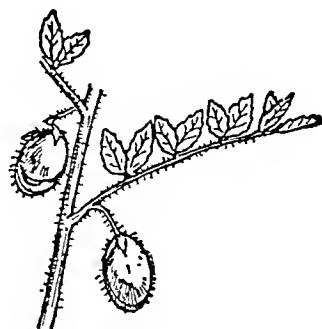
Pulse plants are more important around the Mediterranean than they are in Great Britain. The peoples of Spain and Italy cannot afford to keep large herds of cattle on the scant grass of their arid lands. So they often eat chick peas instead



Lentil



Carob



Chick Pea

THREE COMMON PULSES

Rich nations get the protein (see page 12) they need from meat. Poor nations have to rely on the pulses.

of meat. Spain imports tons of chick peas from Mexico; and from Morocco, Algiers and Tunis they are carried by caravans into the Sahara and there exchanged for dates. Chick peas and lentils are also imported into France and England for making soup. The French supply is mainly obtained from northern India.

In Great Britain from 100,000 to 150,000 acres are given up yearly to the cultivation of ordinary peas and twice as many acres to beans. Peas are suited to cold climates; beans do well in warmer, temperate lands. Some varieties of beans flourish in maize lands, and in Madagascar, where the climate is tropical. The beans of Great Britain are grown mainly for cattle and horses.

In tropic lands, where meat is rarely eaten, the bean is almost indispensable. The peoples of Mexico, Brazil and neighbouring republics depend largely upon it for protein; and in south-eastern Asia, in the hilly districts, which flank the rice-lands, much pulse is grown to supply the nitrogen lacking in rice.

The Soya Bean. In China, Japan and Manchuria the soya bean is grown. This contains three times as much protein as wheat, and of late years it has become an article of great commercial importance. The oil extracted from it is largely used in soap making and in the making of margarine. The crushed residue is fed to cattle; in Japan it is used as a fertilizer.

The soya bean is now commonly grown as an alternative crop in the cotton-belt of the U.S.A., and as an extra, or catch, crop in the spaces between the plants of the maize in the corn-belt. Beans and maize, when grown together, both give good crops. The beans are harvested first.

EXERCISES

1. What is meant by "garden truck" in the U.S.A.?
2. Why do peas and beans form a valuable addition to a diet of rice?
3. What are the chief uses of the potato?
4. Why are beans eaten more by poor people of tropic lands than by people in England?
5. Why are fresh vegetables good for men?

VIII. TROPICAL STARCH FOODS

All plants have the power, when they are in sunlight, of taking in carbon dioxide from the air and turning it into starch. Some plants store up great quantities as food for their seeds. This starch man seizes for his own use.

Plant-made starch, when chewed, is turned by the saliva of the mouth into a kind of sugar which the digestive juices of the stomach further change in such a way that a man's body can absorb such parts as it needs.

In the cold lands around the Arctic seas, man looks to animal fats for sustenance. But in the tropics, where fresh meat soon decays, he has to rely largely on starchy foods. In temperate climates he can allow himself a mixed diet.

The Sweet Potato. One of the most useful of the tropic starch-making food plants is the sweet potato. This is a native of the torrid zone, but can be grown as a summer crop as far north as New York; in its true home, where there is never any frost, it is a perennial. Sandy soils and warm, wet weather suit it well. Cold, on the other hand, ruins it. This susceptibility to cold (even a temperature of 45° F. is too low) makes it difficult to market.

The *yam*, one widespread variety, sometimes grows to a weight of 40 or 50 pounds. In south-eastern Asia it is sliced into pieces like macaroni and dried for winter use. In Jamaica it comes first in the list of native foods.

Cassava. The manioc plant, or cassava, provides the people of temperate lands with tapioca, which is commonly used as a substitute for rice in "milk puddings." Among natives of the tropics it takes the place both of potatoes and of bread. The plant grows easily in sandy soils, provided there is abundance of rain; and it reaches a height of 8 or 10 feet, developing roots some 2 inches thick and, occasionally, as much as 6 feet long.

Like the sweet potato, it is a native of America, but it grows throughout the equatorial lands, from the West Indies eastwards to the Malay Archipelago. In all these lands cassava cakes are a principal article of food. The varieties grown in Polynesia are called by other names, one of the best-known being the *dasheen* or *taro*. A hundred kinds of taro are known and cultivated.

The root, when dug, contains a juice which is a deadly poison. But this is got rid of easily by soaking the root and then drying it in the sun, or by crushing and pressing the root and then baking the dry powder. The European name for the poison is prussic acid.

A great deal of tapioca is produced in Java and the Straits Settlements. Large supplies are also got from Brazil.

The Banana. Most people in the English-speaking temperate lands regard the banana as a fruit rather than a starch food. In the tropics it is looked upon as a rival of the sweet potato, rice and cassava.

The banana will grow luxuriantly, in a belt which goes round the world, wherever tropic forest will grow. The tree has been cultivated so long that it has ceased to produce any seed. But the indolent native, who sticks in a root, and troubles now and again to chop off the weeds around, will have in nine months a tree ready to feed him. All that is necessary is to see the soil is rich and the weather warm and wet. The amount of food per acre to be obtained from the banana is greater than that from any other crop.

Millions of negroes in Central Africa feed upon the banana, or the plantain, which is similar, but, though it makes life easy in the tropics, it is not really a good food by itself, owing to the lack of protein. A man doing hard work in the temperate



A BANANA PLANTATION
in the West Indies. The railway is used for sending the fruit to the coast, whence it is shipped to the U.S.A. and Europe.

cut green, laid in specially prepared railroad cars, and taken to the coast some five or six hours before the ship sails.

regions would probably need to eat ten pounds of bananas a day, and even then he would feel hungry.

A bulky meal of plantain, or of cassava, fills the stomach too full and leaves a craving for meat. That is why peas and beans are so helpful in feeding the poorer Mexicans and the Portuguese of Brazil.

The banana was little known in European countries of the temperate zone before the closing years of the 19th century, owing to the difficulty of transportation. The same is true of New England. Now special lines of steamships rush the branches, or bunches, in thousands of tons from the West Indies and the southern shores of the Caribbean Sea to the U.S.A. and to England. It is said that the U.S.A. imports 6,000 million bananas a year.

Generally the plantations are on low-lying land near a railroad. The railway is necessary to rush the bananas quickly to the coast. Each tree bears one bunch, 150 bananas to the bunch. The bunches are

At the port a continuous stream of labourers passes from the car to the ship, each man carrying one bunch on his shoulder. At the ship's side an elevator takes the bunches on an endless belt and carries them up and then down into the hold. While at sea—to prevent too early ripening—the bananas must be kept at a steady temperature of between 55° and 60° F. This



[Photos : H. Wimmer.]

BANANAS IN TRANSIT

A form of traction commonly used on the railways connecting West Indian plantations with the coast.

is done by forcing cooled air through the holds over the cargo. Other kinds of fruit must not be carried with the banana cargo. Oranges, for example, which are always grown near the banana trees, give off carbon dioxide on the journey over sea; and the gas would cause the bananas to ripen too quickly.

Banana plantations and banana ports are to be found all round the Caribbean Sea, and in Jamaica and other West

Indian islands. The chief are Belize, Bluefield, Port Limon, Cristobal, and Santa Maria, on the mainland of Central and South America, and Kingston in Jamaica. The Canary Islands also send bananas to Great Britain.

The Sago-Palm. The pith of the sago-palm, a tree which grows best in the East Indies, in Borneo particularly, is another important vegetable food. To get the pith, the tree is cut down and chopped into lengths of 2 or 3 feet. The sago-starch is then soaked out.

The tree takes fifteen years to grow. At the end of that time it flowers, and it is then cut down. Ten days' work on a sago-palm plantation will provide a native with food for a year. So easy is the task of looking after the palm, that a single family can do all that is needed on a plantation of 400 trees.

A good deal of sago is exported from Borneo to Singapore in bags made from the leaves of the sago-palm itself.

EXERCISES

1. Why is the banana regarded by some as a fruit and by others as a food?
2. What is the difference between sago and tapioca?
3. What sort of climate is suitable for bananas?
4. Why does a tropical small farmer need a hatcher kind of tool on his farm?
5. Why are starch foods not good in themselves alone?

IX. MEAT FOODS

The men of tropic lands can live upon rice and starchy foods, with some peas and beans thrown in. The energetic white races of the temperate lands, however, do not feel satisfied without meat; and in Great Britain, and throughout north-western Europe generally, the bread foods of wheat and rye are largely supplemented by the flesh of cattle, sheep, pigs, and by such white meats as those of the domestic fowl, the goose, duck and turkey.

The use of salted, smoked, or sun-dried flesh dates back for thousands of years. The freezing of animal carcasses is a recent development. Nowadays chilled or frozen meat is brought to

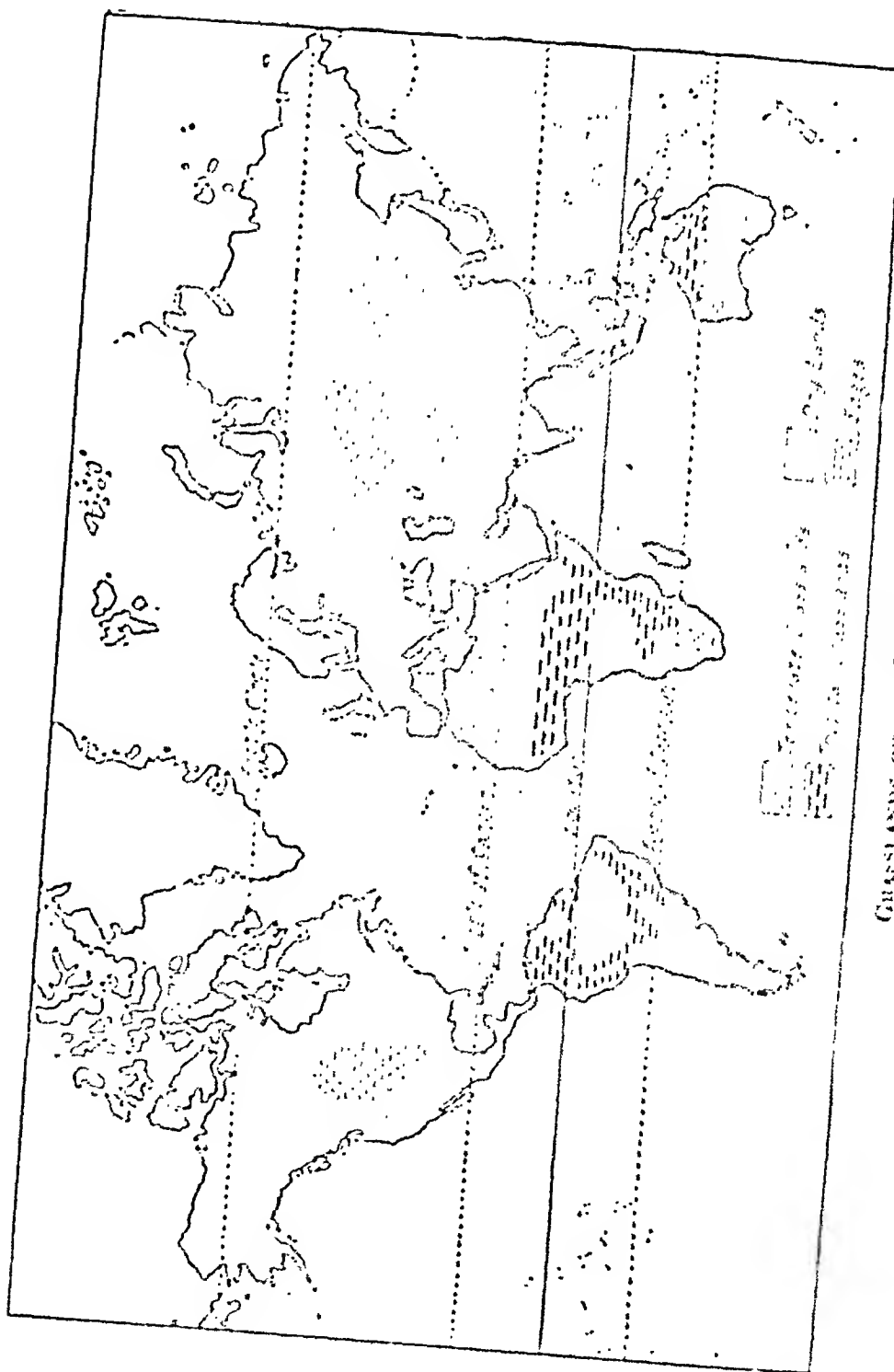
Great Britain and north-western Europe in thousands of tons from the grasslands of America, South Africa, Australia and New Zealand. Of the many inventions of the 19th and 20th centuries, the refrigerator, or freezing machine, has been, perhaps, the greatest aid to man in his efforts to live, and live well.

Beef. Cattle can be kept in all lands which are not too thickly forested, too rugged, too dry, or too near the Arctic Circle. The best places are in the valley lowlands where the rainfall is sufficient to provide an adequate growth of the long, lush grasses that the grazing herds love.

The clay vales of the midlands of England, with their slow-moving meandering rivers, and the salt-impregnated marshy lowlands of East Anglia are well suited to cattle. So are the far-famed river valleys of Devon and the west. For many years grown bullocks from Ireland and Scotland were sent there to be fattened. Nowadays entirely grass-fed cattle are not to be found. The young beasts are given root crops and big allowances of "cake," made from the waste of linseed, cotton seed, soya beans, or palm kernels, after the useful oils have been pressed out. Sugar cane also is now a provider of cattle cake, in the form of "molascuit," a mixture of molasses and the spongy part of the sugar cane.

The principal sources of beef are the grasslands situate between the temperate forests and the arid tropical areas of the world. Cattle can also be kept on the park-like savanas which lie on the outer edges of the equatorial forest lands, but the great ranching areas of the world—those of Canada, the U.S.A., the Argentine and South Africa—are found in temperate climates, lying polewards from the desert belt of the tropics.

Beef cattle may range over wide areas and require little attention, but it has been found that the meat of cattle left to run freely is not so good as that from animals fattened on cake or maize and roots, or on hay alfalfa. So now the two-year-olds are gathered at the annual round-ups; and in North America they are sent to the corn-belts to be fed and fattened before being taken to the meat-packing centres for slaughter. Chicago is the great meat-packing centre of North America.



Grasslands of the World

The ranches of North America lie on the high prairies west of the meridian of 100° W., where the rainfall is too slight for corn growing. The sparse growth of the grass, due to slight rainfall, is offset by the wide areas over which the cattle can roam. In the irrigated valleys of this western region *alfalfa* is now grown.

Alfalfa has deep roots; it can live through long droughts; and, as it belongs to the pea-flower family, it stores up nitrogen in the soil, thus enriching it for other crops grown in rotation. When grazed off by cattle, it will carry a larger quantity of stock than natural grass in semi-arid countries. Much of it is cut as hay.

Where once the waving fronds of the tall pampas grasses covered millions of acres in the Argentine and Uruguay, alfalfa and a similar plant, *lucerne*, are now supreme, making the Argentine the largest beef-exporting country of the world. Railways and British capital and energy have also helped.

A hundred years ago the pampas of the Argentine, stretching inland fanwise for 500 miles from the estuary of the Rio de la Plata, were more like half-wild hunting lands than cattle ranches. Picturesque Gauchos chased rangy, slab-sided, tick-infested cows and steers over the vast estates of Spanish Grandees—much as the original Red Indian hunted bison in North America. The hides were of value, but the meat was only good for boiling down to produce tallow, though some was salted and dried to make into "jerked" beef. The cattle were made, many of them, to walk to the seaports to be boiled down into tallow.

Conditions on the ranches now have entirely changed; and railways carry the live cattle down to the meat-packing centres. Some carcasses are frozen solid and sent abroad, but the greater part of the meat is only chilled and transported in cold storage chambers which are kept at a temperature of about 30° F.; frozen meat is put down to a temperature of 10° F.

In the busy packing centres of the Plate Estuary, meat extracts are prepared, and tongues are "tinned." These provide dainty and savoury foods for European lands.

Of late years dry farming methods, and the developing of newer kinds of cereals, have pushed cattle rearing farther and

farther west in North America and in the Argentine, thus crowding both sheep and cattle raising towards the drier parts. As a consequence cattle ranching is developing in the tropical and subtropical grasslands of northern Australia, Rhodesia, and the Sudan.

Dairying. The keeping of cattle for beef is best suited to the wide areas of new or scantily-peopled countries, where land is cheap and labour dear. In thickly populated lands, where labour is plentiful and land is dear, cows are reared and kept largely for the milk, butter and cheese required by and urban population.

Dairy cows need more careful feeding than ranch-ranging animals, if their milk supply is to be kept up. The milk supply, with its butter and cheese, is more highly valued by the white races of the cool, north European lands than it is in the Mediterranean countries or in the tropics. Olive oil supplies the place of butter around the Mediterranean Sea. Blubber and seal-oil fills the gap for the Eskimo. Coconut oils, and the oil from palm kernels, are used by the peoples of tropic countries.

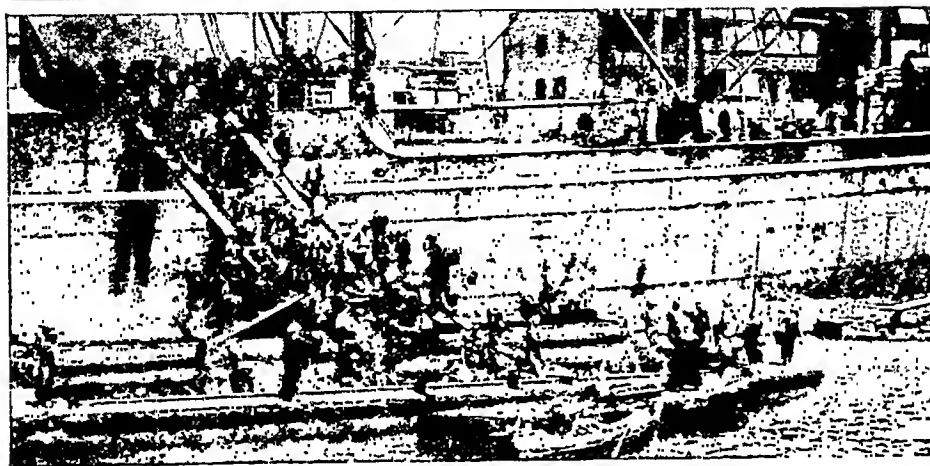
Much of the milk, butter and cheese of Great Britain is produced around the big market centres. Such cheeses as Wensleydale, Stilton and Cheshire have been made for centuries.

Ireland sends to England great quantities of butter and condensed milk. Denmark sends its butter, Holland its cheese, while Switzerland sends millions of tins of condensed milk, also cheese. Nowadays much dry powdered milk is made from the liquid. This is easily transported.

American and Canadian cheeses are exported in large quantities to Great Britain. But New Zealand comes first in the list of cheese-exporting countries; it sends to Great Britain as much as 70,000 tons a year. New Zealand also sends annually to Great Britain more than 60,000 tons of butter, i.e. nearly 150 million pounds.

Sheep. Sheep are reared both for their mutton and for their wool. In southern France and Italy their milk also is used—for making a special kind of cheese.

Sheep kept for mutton need a damper climate and better



[Photos : Australian Government, E.N.A.,
and "Cold Storage and Produce Review."]

FROM SYDNEY TO LONDON

Top : loading a ship with frozen Australian lamb. *Middle* : the ship
coaling at Port Said. *Bottom* : the carcasses in cold storage at the
London docks.

grass than sheep reared mainly for wool. Cool, temperate climates, like those of Great Britain and New Zealand, are especially suitable for producing the heavy, plump, tender, meaty animals that find ready sale in English towns.

England is the chief importer of chilled or frozen mutton.

New Zealand sends to Great Britain £10 million worth of frozen or chilled mutton a year, weighing 150,000 to 175,000 tons. Canterbury lamb, from the Canterbury Plains in the west of South Island, forms the largest part of the huge total. Argentina (including Patagonia) and Australia rank next to New Zealand as exporting countries.

Pigs. Man would often have gone meat-hungry but for the rooting, grunting, garbage-eating hog. Pork, beans, and "hard-tack" were the sailors' fare for centuries, and for some people—those, for example, who work in the miners' camps of America—they are probably still the most common foods.

Australia has 100 sheep to one pig, but in Ireland, Russia, China, and other lands of small peasant-holdings, the pig is here, there and everywhere. Originally, being a forest-living animal, it nosed out his own food. Acorns, nuts, beechmast, roots, grubs and such things were the basis of its feeding; and in autumn it fed full and waxed fat, thus enabling itself to live through the famine time of winter. Now the waste roots and grains—from offal potatoes to bran and barley-meal in Great Britain, to standing maize or the ground corn itself in the corn-belt of the U.S.A.—suit well the pig's digestion.

In parts of the U.S.A. pigs still range the woods. In the Appalachian forests, and in the Southern and Gulf states, the razor-back hog digs up his own feed so cleverly that often he ruins the young pine trees by eating their tap-roots. This power has led many farmers to grow maize solely for the pigs, turning in their stock just before the corn ripens to harvest it for themselves.

These American corn-fed "lard-hogs" fatten quickly and cheaply. They are sent to Chicago, St. Louis, Minneapolis, or Omaha, for slaughter.

Outside the British Isles, the pig-keeping districts of Europe are Denmark (where the animals are fed on buttermilk and imported grain), the potato, rye and barley districts around

the Baltic Sea, and the forested lands of southern Germany and Yugo-Slavia. The flesh of these mast-fed forest swine is mainly eaten locally and so does not enter into world commerce.

The Chinese, too, eat most of their own pork.

The U.S.A. controls the world's trade in lard. The "salt pork" of olden days has disappeared, its place being taken by bacon and "canned pork." Chilled pork has not yet proved successful commercially.

Pigs' bristles are an important article of commerce. They are much used in making brushes. The principal sources of supply are China, Russia, and Germany. The hair and outer skin of some of the foreign swine are much stiffer and tougher than those of the well-cared-for English pig.

Eggs. Great Britain imports 150 million dozen eggs a year. Poultry keeping is an industry which is almost universal. In the U.S.A. the annual value of the produce of the domestic fowl comes next to that of the wheat, maize, hay, and cotton crops.

China is one of the chief egg-producing lands. Each small farmer seems to raise a few fowls, feeding them upon the scraps of food left by the family; and there are factories in the Shantung peninsula for converting fresh eggs into dried, powdered eggs. A thousand eggs can be reduced to a powder weighing only about 22 pounds. The egg powder will keep for a long time.

Besides powdered eggs, China exports each year many millions of frozen eggs. The dried white of eggs is largely used in book-binding, calico-glazing, and in clearing wine.

The Slav states around the Baltic export through Dantzic. Holland, Italy and Egypt send their surplus mainly to Great Britain. Denmark has a very carefully organized egg business. It is possible for the Denmark Egg Export Association to collect and market over 600 million eggs a year.

Hares and Rabbits. Belgium and northern France export each year hundreds of tons of rabbits and hares. Australia sends out tinned and frozen rabbits.

Hares are even more easily raised and fed than poultry, and the British market absorbs far more than are raised in Great Britain itself.

EXERCISES

1. Why do tropic peoples eat less meat than the peoples of temperate lands?
2. Why are pigs particularly profitable on small farms?
3. Where are the big ranch-lands in America?
4. Why do the ranchers rely on "beef" when people of the steppes of Eurasia depend more on milk and cheese?
5. What is meant by cotton-cake, linseed-cake and molasses? What are they used for?
6. Why is alfalfa grown in the American dry lands?

X. FISH AND OTHER SEA PRODUCTS

It has been said that one acre of sea will produce as much food for man as a hundred acres of land. This estimate refers more particularly to the shallow seas of temperate lands, where the supply of fish is most abundant.

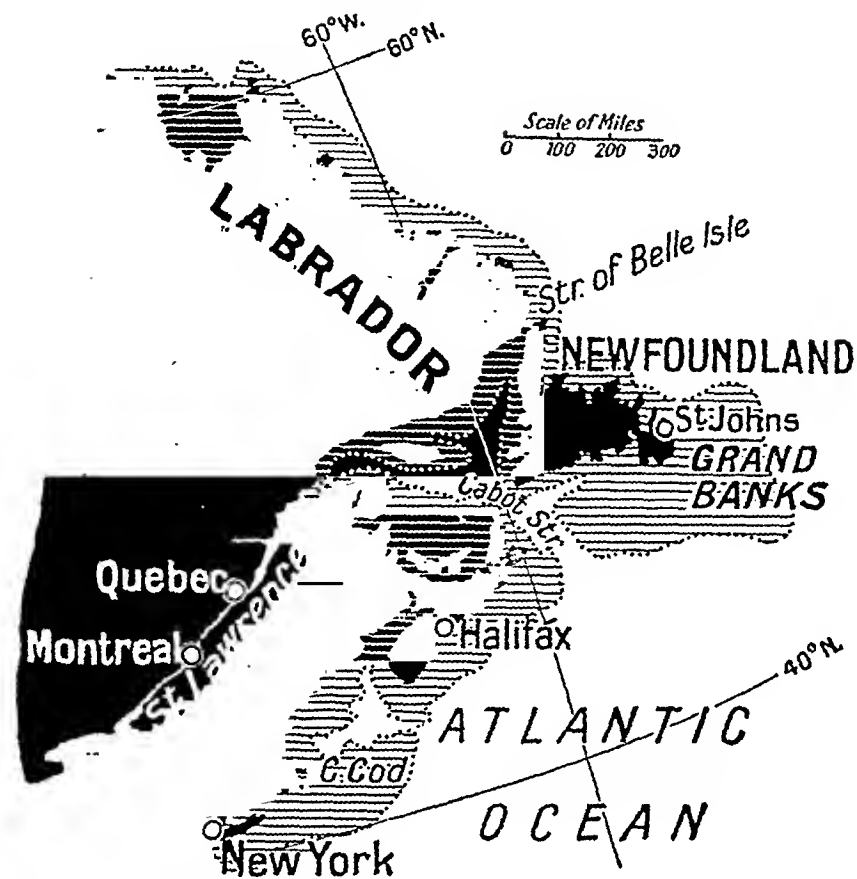
Existing in the apparently clear water of the sea are innumerable tiny plant organisms. These form the food supply of many millions of tiny animal organisms, which are eaten in their turn by the smaller fry among the fishes. The small fry are eaten by the larger fish, which man catches and eats himself. So *plankton*, the small plant and animal fish food, is in its way very important to man's life on earth.

Fishing is probably the most ancient of industries. Men were hunters long before they were farmers, and fishing is one of the few forms of hunting that survives as a commercial industry.

Fishing nowadays is not so important, comparatively speaking, as it used to be. The fish catch of the world, in fact, is actually less valuable than the eggs and poultry produced in the U.S.A. alone. The number of fish caught is greater than it was, say, a hundred years ago, but other things have increased in value to a much greater extent than the fish.

Steam-driven fishing boats have led to wider fishing fields being exploited, and so have increased the possibility of more and fresher fish being placed upon the markets, while the railways and motor vans rush inland tons of fish that in older times could only have been salted or wasted at the fishing ports.

These inventions, however, have made possible the increased



THE GRAND BANKS

use of trawl-nets which are said to destroy the breeding-grounds by scooping up smaller and immature fish, and so giving less chance for the number to increase, or for individual fish to grow. The salmon supplies on the Atlantic Coast of America have been completely killed by indiscriminate fishing.

There are four great regions of deep-sea fishing—that is, of fishing carried on away from the immediate vicinity of the coast. These are all regions of shallow seas, covering continental shelves. They lie:—

- (i) Off the North Atlantic coasts of America—particularly over the Great Banks of Newfoundland.
- (ii) Off the North Pacific coasts of America.
- (iii) In the North Sea, Mediterranean and other European waters.
- (iv) Off Japan and neighbouring coasts.

There are, in addition, many smaller or less important areas, and many river and fresh-water fisheries.

The Grand Banks. Soon after Cabot's discovery of Newfoundland (1497), fishing fleets from Brittany and the West of England began to brave the stormy Atlantic for the summer fishing season on the Grand Banks; and the coasts of Newfoundland were populous with hardy fishers for a few months each year. Some reports say as many as 40,000 men could be found there long before the island was permanently claimed and settled from England.

Cod and haddock catches are the most important, but hake and halibut are also caught. The cod feeds at the bottom of the sea, and is caught on a line, sometimes as much as half a mile long, to which shorter lines, with baited hooks attached, are fastened every four feet or so. The fishing schooners send out row-boats, or "dories," to lay the lines and take off the fish. Most of the fish are cleaned and salted on the schooner as soon as the dories bring them in. Afterwards, when taken to port, they are dried in the sun.

Salted and dried "stockfish" are nearly as hard as wood and look about as appetizing. They need soaking for twenty-four hours before being cooked; but they can be sent anywhere, and will keep for almost any length of time.

Newfoundland cod, in the form of "stockfish," are a common food of the negroes in Jamaica and the West Indies generally. They are also eaten largely in South America.

The people of Newfoundland and Labrador depend upon fish. Those who are not actually employed in catching are salting, drying, or extracting oil. This has been the case for over four centuries, though of late years wood-pulp and iron have provided an increasing amount of work for a non-fishing population. The value of the fishing products is about £4 million a year.

The people of Nova Scotia and the New England states of the U.S.A. also join in the fishing. Boston, indeed, is the most important fishing port in America. It has a fish-pier where eighty vessels can unload at once, and on or near it is a large fish-freezing and cold storage factory. Frozen fish are

not yet as important commercially as is chilled or frozen meat, but the industry is developing.

Fishing within a limit of three miles of the shore is territorial and limited to the people of the country owning the coast. Fishing outside the three-mile limit is free to all. The Grand Banks of Newfoundland are thus free. For a long time, however, disputes occurred between France and Great Britain as to the fishing rights on the Newfoundland coasts. The French own two small islands—Saint Pierre and Miquelon—south of Newfoundland, but, though they may catch bait and erect temporary drying sheds in certain parts, they may not settle on Newfoundland itself.

Lobsters are trapped all along the coast from the St. Lawrence southwards. They are tinned or "canned" and exported in great quantities to Europe. In Chesapeake Bay is a valuable oyster fishery.

In the Great Lakes, whitefish, trout, sturgeon and a kind of herring are caught. The whitefish are much prized throughout Canada and the U.S.A., and are transported fresh in refrigerating trucks over the interior of the continent.

The North Pacific. Along the Pacific coasts of America cod, herring, and halibut are caught, but the salmon fishery is, commercially, the most valuable. The salmon lives the greater part of its life in the sea, but returns to lay its eggs in the fresh-water river where it was hatched. Salmon fishing is a river fishery.

Salmon are found in the rivers of north-western Europe, but, except in Scotland and parts of Ireland, very few are caught now in the British Isles, owing to the pollution of the river waters by factories. In eastern Siberia some 150 million are caught each year, mainly from the Amur River, but even this number is small compared with the number caught in Alaska and British Columbia. There some 400 million, worth £10 million or more, are caught annually.

At one time, salmon swarmed in every river all the way from California to Bering Strait and the Yukon, but so many have been caught that it is feared the fisheries may become exhausted, as have those on the Atlantic coast. Canneries were first started in California and the Columbia River. Now



HAULING IN THE CATCH

in a North Sea Drifter. The British fishing industry in the North Sea employs more than 3,000 steam vessels and between 80,000 and 100,000 men.

they are found principally in the far north, on the Alaska Rivers. In the Yukon River salmon are very abundant.

Nowadays the incoming salmon are caught by a kind of wheel which has wire buckets attached to it. As the wheel revolves in the current, the fish are caught by the baskets and thrown into a boat below. They are then taken to the canneries. There, during the short season, Chinese workmen are kept busy cleaning, cutting, and putting the slices in the tins, and then boiling and closing the full tins, so making them air-tight.

In winter the canneries are deserted. Boats, ships and men have returned to their home ports in warmer climates.

Seattle is the principal centre of the industry in the U.S.A. There working expeditions are organized; there the catch is received, and thence it is distributed throughout the world. The annual value of the salmon fishing industry of the U.S.A. ranges from £8 million to £10 million.

The North Sea. The North Sea is probably the greatest fishing ground in the world. In the whole sea the water is

nowhere more than 100 fathoms deep; and around its shores are populous countries whose coast-wise people have developed during the ages into expert fishers and small-boat seamen. The total value of the annual catch amounts to some £50 million, Great Britain's share being as much as £20 million.

Besides sailing boats, Great Britain has over 3,000 steam fishing-boats engaged in the industry, which employs between 80,000 and 100,000 men. The Dutch have about 20,000 fishermen. The British fishing ports, with the notable exception of Fleetwood, lie mostly on the North Sea coast. Grimsby



[Photos: Messrs. MacFisheries, Ltd.]

STEAM-DRIFTERS AT YARMOUTH,

one of the centres of the British North Sea fishery. Other centres are Aberdeen, Grimsby, Hull, London and Lowestoft. Billingsgate, London, is the best known fish market.

is the greatest in the world. Aberdeen, Hull, Yarmouth, Lowestoft and London are other important centres. At Billingsgate, in London, is the best-known fish market.

Soles, turbot and plaice, in addition to cod and haddock, are caught or dredged from the Dogger Banks. The herring fishery, however, is the greatest of all the North Sea fisheries, both in value and in quantity. The herring appears in spring off the Shetlands and swims in shoals, or schools. From these the fishermen take their toll in drift-nets. As the year progresses, the herring are found farther south, finishing in late summer and autumn off the Yarmouth and Lowestoft coasts and, later still, south of the Thames estuary. Half a million tons of herring have been caught in a year. Many of the fish are salted, smoked, and dried, becoming in the process "good red herring" which will keep almost indefinitely.

Fish is the only form of food which Great Britain exports in quantity.

The Norwegian coasts provide scant living for farmers, but in the fishing season farmers and tradesmen alike turn out to fish. Cod and herring are the most important catches; the northerly Lofoden Islands are rich in cod. Norway exports nearly two-thirds of her cod catch, either salted and dried, or as cod-liver oil. She also exports many thousand tins of small brisling—once known as sardines.

The sardine fishery was early associated with Sardinia, from which the fish (really a small pilchard) takes its name. The most important sardine fishery is that of Brittany, where nearly 100,000 people are dependent upon it for a living. Packed in small tins, in olive oil or in tomatoes, the fish is a great dainty.

The pilchard proper is caught around Cornwall. Mackerel, like herring and pilchard, are open sea surface fish and are caught in drift-nets.

Rich fisheries are now exploited near Iceland and in the White Sea; and the steam trawler and refrigerator together have combined to make the catch transportable to London and other markets.

The Mediterranean. In the deep Mediterranean fewer fish are caught than in the shallow North Sea, but the catch of tunny fish, a giant among fishes, is fairly important.

At one time huge sturgeon—often 8 to 10 feet long—were common in the Volga and other Russian rivers. The eggs, or roe, of the sturgeon were sold as caviare; but so great was the demand for Russian caviare that the sturgeon was almost exterminated as the result of indiscriminate fishing.

The Japan Fisheries. Japan is an island, mountainous country, with a large population, and cultivable lands which are comparatively small. Thus, since the inland seas and openings of its coasts are well-stocked with fish (herrings, haddocks and sardines), many of the coast-living peoples of the four thousand islands which make up the country look to fishing for their livelihood. Fish, indeed, is the chief animal food of the 50 or more millions of Japan's population.

Japan has secured by treaty with Russia fishing rights along 12,000 miles of the Siberian coast, with permission to land and to cure, salt, or can the fish caught. Many of the tiny farm holdings, or farm gardens of Japan are fertilized with refuse parts and non-edible fish. Salmon and plaice are caught in the large, cold island of Sakhalin, north of Japan proper.

Sealing. In the cold waters of the Arctic Seas seals and whales were at one time very plentiful. The seal eats fish, but it rears its young on the coasts. Being a sea-mammal, not a true fish, it must come up to breathe, and the patient Eskimo of North America watches in the dreary winters for the chance to spear his quarry when it clambers up through the thin ice near a breathing-hole.

The common seal of Labrador and of the shores of Davis Strait and Baffin Bay is sought by white fishers for its leathery skin and oil. Steam sealing-ships set out annually from St. Johns, Newfoundland. Many seals are caught on floating floes of ice which have broken off and drifted down with the Arctic current. The industry has fallen off of late years, but seal-oil and seal-hide still form a valuable part of Newfoundland's exports.

Fur seals live on the coasts and islands of Bering Strait. At one time they numbered thousands, even hundreds of thousands, but steamships and modern guns have enabled seal-hunters to take and kill so many that in some places the herds are almost killed off.

Now the chief gathering-place of the fur seal is on the Pribilof Islands, in the Bering Sea. This is an outlying possession of the U.S.A., and the right to take seals is under government supervision. Thus careless slaughter is prevented, the number of skins or pelts taken being strictly limited. As a consequence, the herds are again increasing, and a steady flow of about 20,000 pelts a year can be maintained. St. Louis, in the U.S.A., is the chief centre of the auctions of seal-furs.

Whaling. Whale-hunting, both in Arctic and in Antarctic seas, was of very great importance in the early part of the 19th century, before gas, electricity and petroleum came into general use. Up to the middle of the 19th century, whale-oil and seal-oil were the chief sources of the necessary fats for candle- and soap-making.

So strenuously was the true whale, or Greenland whale, hunted that the whale fisheries became practically exhausted in the northern polar seas. The Scottish whaling ships from Dundee and Peterhead were then stopped, as were those of the New England states of the U.S.A. Whale-oil was found in the blubber, a coating of fat under the whale's skin.

Off north Norway and off Iceland, bottle-nosed whales are still hunted for their oil. The Norwegians make a kind of "corned beef" from the flesh of the whale. Some is exported.

Sperm whales are hunted, in tropic waters mainly, for their sperm-oil, which is found in a huge cavity inside their heads. Sperm-oil is used with beeswax in making *spermaceti*; a component of candles and many kinds of cold cream and face-salves. *Ambergris*, a substance largely used in making some kinds of perfumery, is got from some sperm whales.

The most profitable whale fisheries of the present time are found in Antarctic Seas, to the south of the Falkland Islands, and to the south of Africa. The headquarters of the whalers from South Africa are at Durban, in Natal.

Whalebone, once a valuable product of the Greenland or true whale, is now little used, having been superseded, in the making of umbrellas, by the slimmer, lighter, hollow steel ribs of modern manufacture.

Pearl Fishing. The ordinary oysters of temperate lands, such as the U.S.A. and England, do not contain pearls. Now

and again pearls are found in freshwater mussels. The real pearl, however, is a product of oysters found in tropic waters.

The best-known pearl fisheries are those in the Persian Gulf, off the Bahrein Islands. There is another fishery off Ceylon, and one to the north of Australia, near Thursday Island. Some pearls, too, are found along the coasts of Venezuela and in the Gulf of California.

Sponges. Sponges grow at the bottom of warm, shallow waters like those of the Mediterranean Sea. The Greeks have for long been famous as sponge-divers, and many are now employed in the warm waters of the West Indies, particularly at Tarpon Springs in Florida. Nassau, in the Bahamas, is another important centre. The finest sponges, however, are still found off the coasts of Morocco and Tunis, in the Mediterranean.

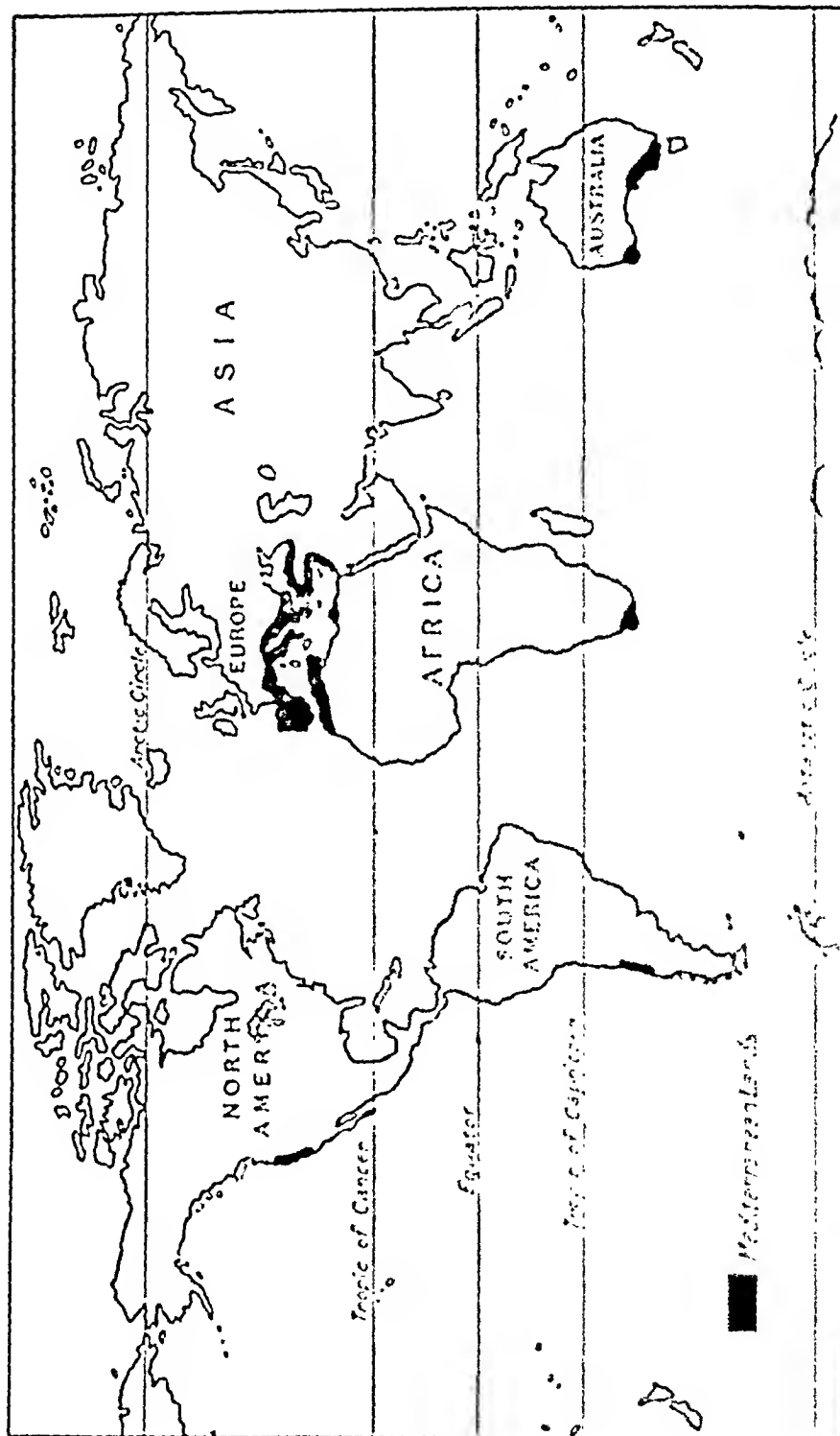
The sponge is the skeleton of a jelly-like sea animal that, when living, occupies the pores or hollows between the fibres of the commercial article. The living animalcules look more like a coating of slime than anything else.

EXERCISES

1. Why is trade always possible between a shallow sea-coast and the hills behind?
2. Make a map to show the lands around the Dogger Bank.
3. Why is the foggy, dreary island of Newfoundland better liked now than in the 16th century?
4. Why are the rivers of Alaska valuable?
5. Write an account of a day's work on a fishing schooner on the Grand Banks.

XI. THE FRUITS OF THE WORLD

The modern fruit shop serves as a striking demonstration of the extent to which we who live to-day are indebted to science and to means of rapid transport. Railway trains, ships, motor-cars and aeroplanes now rush fresh fruits to distant shores in time for them to be eaten while they are still good; and science not only enables us to can or to freeze fruits so that they will keep for weeks, months or years, but teaches how new varieties of fruit may be developed, also how lands may be fitted with the plants that will best grow there.



MEDITERRANEAN LANDS

Lands of sunny summers and winter rains, where olives, oranges and grapes flourish, are so called because the largest area of this climatic type lies round the Mediterranean Sea (see pp. 19 and 72).

The consequence is that people everywhere, instead of having to be content with fruit grown within a few miles of their homes, and with eating it just when it is ripe, can call upon the whole world to supply them, and can eat what they will, enjoying it whenever they like—not merely at the time of ripening. Even people who cannot hope for fresh supplies, men in Arctic wilds or Tropic seas, can enjoy excellent canned fruits and vegetables.

Fruits of Temperate Lands. The apple, the pear, the plum and the cherry belong to Great Britain and other temperate lands, as also to the small bush fruits—currants and gooseberries. Raspberries, strawberries and loganberries, too, are raised in Great Britain, but many tons are imported each season from over the narrow seas.

The apple is the commonest fruit of cooler northern temperate lands. For long centuries it grew wild in the Old World—from the Atlantic coast to the Pacific coasts of China ; the crab apple of to-day is the lineal descendant of the old-time hardy strain.

The overseas trade in apples is immense. Although there are nearly a quarter million acres of apple orchards in Great Britain, millions of barrels of apples are imported from northern Europe, Canada, the U.S.A., Australia, New Zealand, and South Africa.

The lands of the southern hemisphere do not yet export such large quantities as are sent from North America, but their crops ripen at a different season, and so fill a gap, when apples grown in the north are scarce.

Canada sends to Great Britain each year apples worth £1 $\frac{3}{4}$ million; her total annual production reaches nearly 3 million barrels. Australia, with Tasmania, sends almost as many. Great Britain imports altogether well over a quarter of a million tons a year.

The eastern and southern shores of the Great Lakes and British Columbia are the two great apple-producing parts of Canada. In the Lake Peninsula, between Lakes Erie and Ontario, the cooler air from the lakes in spring saves the apples from blossoming before spring frosts are over, while the warmer air from the lakes in autumn keeps away the early frosts of autumn, which often devastate the prairie lands.

MEDITERRANEAN LAND

Lands of sunny summers and winter rains, where olives, grapes and pinyon flourish, are so called because the largest area of this climatic type lies round the Mediterranean Sea (see pp. 40, 41, 72).

Mediterranean Fruits. In the Mediterranean lands the peach, the apricot, the nectarine, the melon, the grape, the orange, the lemon, the pomegranate and the fig can be grown without artificial heat. Nuts, the almond, chestnut, walnut and little Barcelona nut, also thrive in these regions. The date-palm flourishes on the desert's edge and in the scattered oases. The olive tree lives and bears its oily fruits for centuries without replanting, and the mulberry tree provides leaf food for the silkworm.

The peach is difficult to transport, for it can be kept only about ten days. It has to be picked on the day it is ripe; a day before it is too green, the day after it is too soft. It is probably a native of Persia, but has been acclimatized eastward in Japan, westward in America, and southward in South Africa and Australia. In California peaches are grown mainly for canning, but supplies are rushed by special trains to New York and are sent at times even to London.

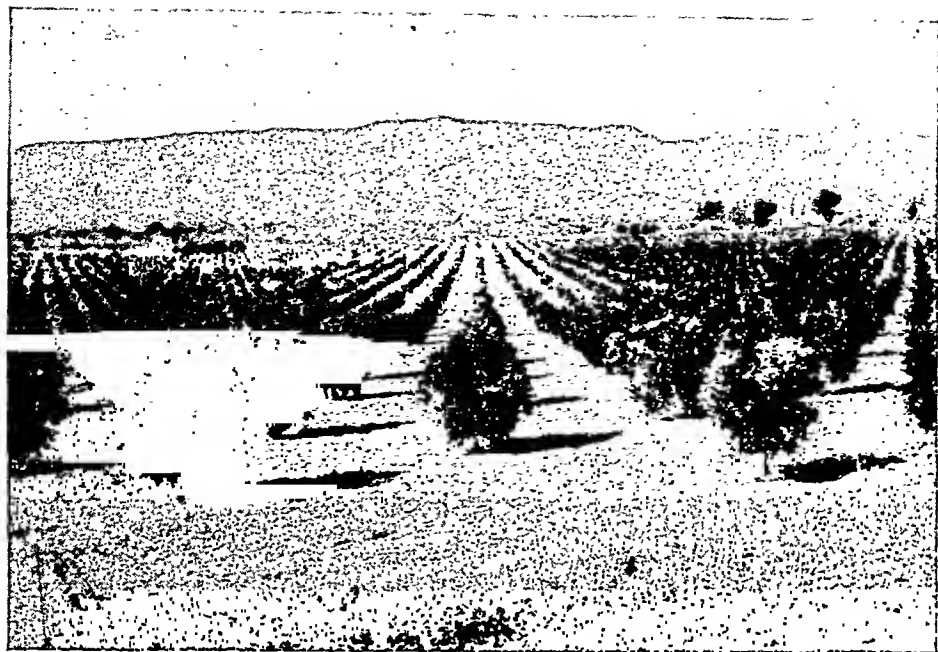
Some peaches now are exported from Argentina and South Africa, generally on mail steamers in February and March. South Africa has $5\frac{1}{2}$ million peach trees; California twice as many.

The apricot is more liable to be killed by frost than the peach, which it resembles. Dried apricots have been a favourite food in Central Asia and Tibet for very many centuries. Northern India sends them to Tibet over the Himalayas. Russia now gets supplies by railway from Turkestan.

Citrus Fruits. The citrus fruits flourish in the Mediterranean area and in warmer lands, such as the West Indies, California and Florida. The chief varieties are the orange, the lemon, the lime, the citron, the grape-fruit, and the Japanese *kum-quat*. Actually the home of these supposedly "typical" Mediterranean fruits is not the Mediterranean. The orange is really a native of China; it was introduced into southern Portugal and Spain after Vasco da Gama had discovered (1498) the sea-way to the East.

By reason of their thick, tough, oily and bitter skins, the citrus fruits can be transported, while many more tasty, and more truly tropic, fruits cannot be sent to the temperate lands.

The orange is a small bushy evergreen tree which grows



FRUITS OF MEDITERRANEAN LANDS

Top : a South African citrus grove. *Bottom :* a South African orange orchard. The export of "Empire grown" citrus fruits, from Australia and South Africa, is steadily increasing.

throughout the tropics and on the warmer edges of both temperate zones. It produces the finest fruit nearer the colder limits of its growth.

The most northerly limit of orange growing is in Europe, where the combined warming influences of the Mediterranean Sea, the Atlantic Ocean, the Sahara, and the sheltering mountains in the north make the Mediterranean region peculiarly suitable. In America the limit north is 37° in California, $31\frac{1}{2}^{\circ}$ in the east.

More than half the oranges and lemons imported into Great Britain come from Spain, though a large number come from Italy. Sicily also sends lemons. France imports from Algeria. The U.S.A., which once had a large import, now exports some 2 or 3 million boxes a year from California and Florida, besides satisfying her own home market. The exports from South Africa and Australia are increasing.

Jaffa oranges and those from the Azores are of excellent quality. Bitter oranges from Seville, in Spain, are much used in making marmalade.

Tucuman, in the Argentine, is now producing a high-class orange.

Grape-fruit have been much improved of late years. Florida produces as many as 8 million boxes a year. The fruit is also grown in Cuba, Porto Rico, California and South Africa. Canned grape-fruit is exported from Porto Rico.

Limes require warmer weather than oranges and are more easily frost-bitten. They are grown chiefly in the West Indies. Dominica has the largest production. Montserrat gives its name to lime-juice.

Figs. Figs can be grown all over the Mediterranean region. Like the orange, the fig tree cannot be cultivated on the table-lands of Spain, nor on the colder highlands generally. Figs grown for export are produced mainly at the eastern end of the Mediterranean Sea, Smyrna figs being especially noted. They are most generally exported as dried fruit. California now has an increasing trade in figs.

Dates. The date-palm provides the bread of the desert. As it requires much water at its roots, it is grown in the oases or along river banks; a burning overhead sun does not harm it.

The tree grows right across the warm arid lands flanking the Sahara, and eastward into Mesopotamia which, with Basra as its port, is the chief exporting country. The French have built railways in Algeria, across the Tell and the Atlas Mountains, and so now can tap date supplies which are brought by caravan to the railway termini.

The date crop is very prolific. Each tree will yield anything from 100 to 200 pounds of fruit a year, and go on doing it for more than a century. Under the date-trees, apricots, figs or olives can be grown, and under them again beans and vegetables.

Dates are now grown in the arid south-western part of the U.S.A., particularly in the lower Colorado Valley and parts of California. California specializes in high-class dates.

Pine-apples. The pine-apple is the fruit of a low, stemless plant. It is formed in the centre of a cluster of long, stiff, sharp, sword-like leaves. The plant grows best in moist, but rich, light and sandy soils, near the sea, in tropical and sub-tropical lands. The fruit is picked green and ripens in transit. Europe gets its supplies from the Azores and Canary Islands. American sources are Florida, Hawaii and the West Indies.

Large numbers of pine-apples are sliced and tinned. In this form the fruit is most used and best known in Great Britain.

Olives. The olive is pre-eminently the Mediterranean tree. It will grow wherever the Mediterranean type of climate holds sway, and nowhere else. A native of the eastern Mediterranean, it is now cultivated also in California, Mexico, and parts of Australia.

The tree is a small evergreen, and its leaves, silvery-green in colour, shine with a kind of natural wax which they exude to prevent evaporation of moisture during long, dry spells. The bark is thick and rough for the same reason. As the rainfall in the Mediterranean areas is of the short, heavy, thunderstorm type, and not regular even in winter, the surface land is often dry for long spells. Bushes and trees, therefore, must have roots which penetrate deeply into the soil for moisture, and leaves of a mackintosh kind—but to prevent wet coming out, not to prevent wet going in.

In between the boulders of poor, rocky hill-sides, with dry, gravelly, limestone soils, the olive will thrust down its long

roots and live for ages, provided the hill it clings to will shelter it from cold winds. It takes a long time to grow—15 years at least. Sometimes 40 years elapse before it reaches its maximum yield. But once it begins to yield, it keeps up the process for as many as 1,500 years. There are olive groves in Tunisia which must have been planted in Roman times; they were certainly bearing fruit before the Saracen-Arab incursion in A.D. 648.

The olive is a wonderful food producer. The oil from its plum-like fruit supplies the place of butter and other animal fats in Mediterranean lands. The whole fruit is sometimes pickled.

Great Britain gets olive oil mostly from Spain, but the oils of the Rhone valley, in southern France, and of Lucca, in Tuscany, are reputed to be the best. Five million acres, containing 300 million trees, are devoted to olive cultivation in Spain. Italy has 100 million trees, producing 50 million gallons of oil a year.

Mediterranean Nuts. Walnuts ripen in England, and are eaten and sometimes pickled; whilst some use is made of hazel nuts, a wild wood product, and imported Spanish chestnuts serve as a luxury for odd occasions. In Mediterranean lands, however, chestnuts, almonds and hazel nuts are deliberately planted and cared for as food supplies.

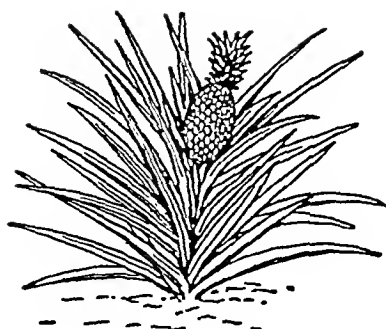
On the southern slopes of the hills in central France, on the old tableland of the Auvergne and on the Cevennes, roast chestnuts, boiled chestnuts, and chestnuts as a kind of mush, are almost daily fare.

Spain, Morocco and Italy all export almonds to Great Britain. Spain has over 7 million almond trees, producing 2 million cwt. of almonds, 200,000 tons of nuts that is worth nearly, £4 million; and there are in Spain some 2½ million hazel nut trees, providing the Barcelona nut of commerce.

Tropic Nuts. The Brazil nut is the fruit of a tall tree that grows in the sweltering Amazonian forest lands. The whole fruit contains as many as twenty nuts inside an outer shell which is as large as the head of an average man.

The coco-nut palm grows luxuriantly in the wet lowlands of tropic lands, near the sea. Its graceful, feathery leaves are one of the attractions of tropic scenery. The nut is an important

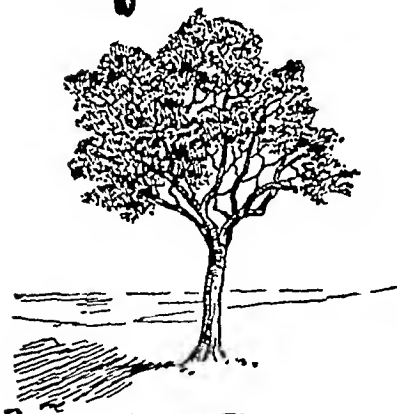
Date Palm



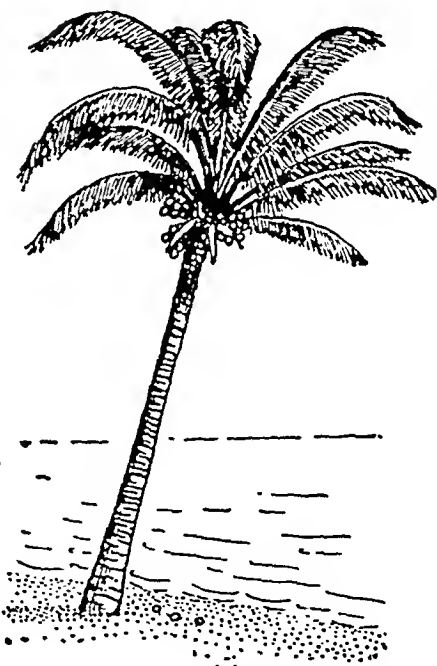
Pineapple



Olive - leaves
& fruit



Olive Tree



Coco-nut Palm

FOUR VALUABLE FOOD PRODUCERS

The date-palm provides the "bread" of the desert, and the olive tree the "butter" of the Mediterranean Lands. Pineapples, sliced and canned, are well known in British homes, whilst of almost every part of the coco-nut palm some use is made by man.



SELECTING FRUIT

Girl workers picking out damaged and discoloured sultanas in an Australian dried fruit factory.

article of native food, the milk being very refreshing and nutritious.

Along the shores of the Caribbean, coco-nut plantations have been made for the supplying of fresh nuts to the American market. In Ceylon, thousands of acres have been planted for the supply of *copra*, or dried coco-nut, from which is obtained the coco-nut oil now used in making margarine, soap and candles.

The outer husk of fibrous material, or coir, is used for making matting and ropes. Almost every part is useful to the native races. From the sap of the flower-head intoxicating liquors, toddy and *arrack*, are made. The leaves and wood are used in hut building.

Ceylon has over $\frac{3}{4}$ million acres under coco-nut trees and has exported in recent years an average of some $\frac{3}{4}$ million cwt. of desic-

cated coco-nut, $2\frac{1}{2}$ million cwt. of copra, and $\frac{1}{2}$ million cwt. of coco-nut oil. The copra is worth approximately £2½ million, and the coco-nut oil £1 million. Coir exported is worth about £½ million a year. India exports £½ million worth of coir yarn yearly in addition.

Dried and Preserved Fruits. There is now a very large trade in both dried fruits and canned fruits. In the sunny, rainless Mediterranean summer it is fairly easy to dry grapes into raisins, and plums into prunes. The grapes are frequently dried by half-slitting through the stem and leaving the bunch still suspended on the stalk. From Valencia and Malaga, in Spain, large quantities of raisins are exported.

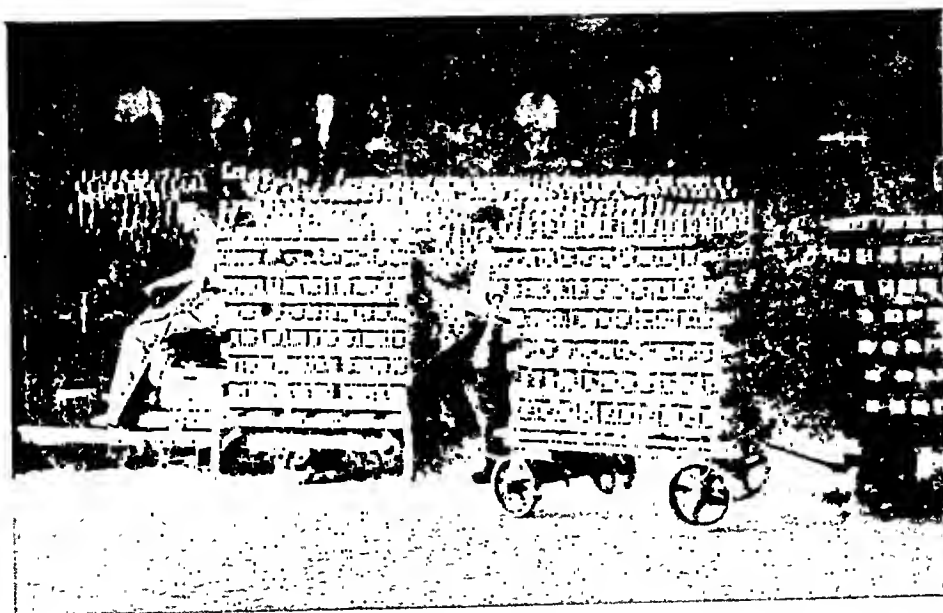
Seedless sultanas are exported from Smyrna, in Asia Minor, and from Greece.

The dried currants of commerce were for long almost a monopoly of the Greeks. Greece sends nearly £2 million worth of currants to Great Britain yearly. The Greek currant is a kind of small seedless grape.

California has of late years largely entered the dried fruit trade, capturing the American home market and exporting to Europe.

In South America, fruits are grown and dried in the Great Valley of Chile, and in the Argentine, near Mendoza. South Africa and Australia also export dried and canned fruits.

The trade in canned or tinned fruit and vegetables is rapidly growing. Even unripe maize cobs are canned in America and used all over the U.S.A. Tinned pears, pineapples, peaches, plums, apricots, etc., may now be seen in every grocer's shop, and a very great proportion show by their labels their Californian origin. Fresno, in California, is the most notable centre of the fruit-canning industry.



PEACHES AND PEARS

A scene in an Australian canning factory. Workers stacking tins of fruit for labelling prior to export.

EXERCISES

1. Why did the ancient Greeks call the olive "the Gift of the Gods"?
2. What classes of fruits and trees are suited to Mediterranean climates?
3. Draw a map to show the chief citrus fruit lands of the world.
4. Why were the Saracens and Arabs a help to agriculture in some lands?
5. Why does the U.S.A. nowadays import so few dried fruits and grapes?

XII. WINES AND OTHER DRINKS

Water from a crystal spring is a delightful drink, very refreshing and very healthful. But clear springs are rare in lowland regions; and river water and water from standing pools is apt to get contaminated, and to inflict malaria, cholera or other diseases, on people who drink it.

So man, long, long ago, learnt to boil his water and to add something to it to give a flavour he liked. He learnt, also, to make drinks that would keep good for a time, and that would cheer his heart and body when he felt cold or depressed, whet his appetite for dry and monotonous food, or enable him to do honour to a welcome guest.

Beer. The men of the Nordic races at first drank barley-water sweetened with honey. This grew later into ale or beer, and mead, according to the mixing. "Bere" was an old name for "barley."

In later centuries the ale or beer was flavoured with hops, horehound or other herbs to give it a bitter tang. The very sweet drink provided for ladies and feasts had more honey in it, and got the name mead to itself.

Some of the starch in the barley grains, after they have been boiled and left standing to cool, turn into a kind of sugar called *diastase*; from which develops the preserving and intoxicating spirit now known as *alcohol*.

The hop is a slender twining plant with clusters of small greenish flowers. The flowers, without seeds, are used in brewing. The plant, which has been grown in England only since 1525, is fairly common in northern Europe. Kent is the chief hop-growing county in England.

Climate and Thirst. Nearly all fruit and vegetable juices will "ferment," and develop alcohol, or some similar intoxicating spirit, when heated and then left to cool; and nearly all races in all climates have some favourite form of "brewing" which makes for them an enlivening or intoxicating drink. The fruits and juices and the resulting drinks vary, as do the quantities consumed.

In the wind-swept, bleak northern lands of Europe, working conditions induced strong, hearty appetites; and men ate and drank, worked and fought, and ate and drank again. In more southern lands, where the Mediterranean summer ruled, the juice of the grape with its acid, sharpening flavour became the favourite drink. In the hotter lands of the tropics and monsoons, alcoholic drinks gave place to boiled water infused, in China particularly, with tea, or, in desert lands, with coffee. Nomadic pastoral races drank the milk or buttermilk of their horses, sheep, cattle or goats.

Modern transport and science make available any kind of drink almost anywhere.

Wine. The vine is indigenous both in the Old World and the New, and the grape is, and always has been, cultivated wherever climatic conditions allow; grape seeds have even been found in the old Swiss lake dwellings.

In order that it may ripen, the grape needs a long summer, with long, sunny days of blue and cloudless skies, and it must have a frost-free season of five or six months. Yet, curiously enough, the grape vine does not prosper where the climate is entirely free from frost during the cooler seasons. Moisture is necessary to it in the spring. During summer droughts, long tap roots seek out the liquid food the plant needs. Too much rain, therefore, makes the fruit watery.

The northern limit of vine cultivation in Europe varies from $47\frac{1}{2}^{\circ}$ N. latitude, near the mouth of the Loire in France, to about 53° N., in Poland. The line showing this limit drops southward in Russia, where the summers, though warmer, are shorter. Hill slopes facing south or south-westerly, like those of the Rhine and its tributaries, the Neckar and Moselle, are very suitable. In America, the northern limit runs from about 37° N., in California, to 40° N., near the Great Lakes.

France, Italy and Spain are the principal grape- and wine-producing countries. Between them they produce five-sixths of the world's annual supply. Centuries of hereditary skill in planting, growing, tending, squeezing, blending and mellowing, have given the old-established wine-exporting countries a long lead in the trade.

The kind of soil has an important influence in deciding the blend and flavour of the wine. Many countries can make wine, but much wine that is made is not of any value in commerce; people of importing nations will not buy it. Like the *vin ordinaire* of France, therefore, it is drunk at home, often mixed with water.

The rarest wines of commerce are definitely localized. *Champagne* comes from the dry slopes of the chalk hills in Champagne, around Rheims. It is cooled and mellowed in underground cellar caverns of great antiquity and size. *Burgundy* comes from the slopes of the Côte-d'Or, near Dijon, in old-time, sunny Burgundy; *Charet* from the Garonne valley slopes, near Bordeaux. *Sherry* is named from Jerez de la Frontera, near Cadiz, in southern Spain. *Port* is named after Oporto, in Portugal. *Hocks* are Rhine wines, made in Germany. *Tokay* comes from Hungary, from the southward slopes of the Carpathians.

Australian and South African wines are named mostly after French wines, but they have a definite character of their own.

One-third of the cultivated land of Italy is under the grape vine and over a billion gallons of wine are produced each year. France has a much smaller area under vines, but a larger production. The French drink an average of 25 gallons of wine per head per year. In Great Britain only $\frac{1}{2}$ gallon per head is drunk.

Curiously, France is both the greatest importer and exporter of wine. The named French wines are exported; cheaper foreign wines are imported. Algerian wine is now mostly sent to France, where it is drunk or blended to re-export. Currants also are imported into France for wine-making.

In some years as many as 200 million gallons of wine are imported into France. The export is about 50 million. But the imported wine is only worth half as much or less per gallon.



[Photo : Gonzales Byas & Co.]

A TERRACED VINEYARD

in the Douro wine district, Portugal. Grapes, in order that they may ripen well, need long and sunny summers, but the vine does not flourish in lands entirely free from frost in the cool season.

Spain exports grapes to the value of about £1 million a year, in addition to wine, but wine is her most valuable export. She makes 500 million gallons a year, and grows 6,000 million pounds of grapes.

Wine producing in the southern hemisphere is roughly bounded by the line 40° S. latitude. Around Santiago, in Chile, there are large vineyards which supply the wine-drinking people of Chile. The wine district leaps the Andes and appears again in Argentina, around Mendoza. There terraced hill-sides are irrigated from the snow-capped Andes, and the descendants of French wine-growers raise grapes and make wine for the people of the Pampas and the seaports on the Paraguay-Parana estuary.

At one time California was developing into a wine district, but now wine making is prohibited in the U.S.A. California, therefore, specializes in raisins and table grapes.

Tea. The tea known to the commercial world is the dried leaf of an evergreen shrub, or small tree, native to the hills of Assam, in north-eastern India. The shrub is one of the hardiest of the subtropical plants; and, provided the spring season is warm and wet, winter frosts will not kill it, though they may reduce the yield. The climate which it likes best is one that is warm, moist and equable throughout the year.

The tea shrub needs plenty of rain, even in summer, but it does not do well in wet soils; well-drained hill-sides in monsoonal countries suit it admirably. The soil must be rich, with plenty of *humus*, or leaf-mould in it such as is found in virgin forest land after clearing. Red soils should be chosen if possible; they contain iron, which seems to be helpful to tea-plant growth. As the leaves are plucked by hand, cheap labour must also be available.

The tea plant is generally kept pruned down to about 3 to 5 feet in height. This facilitates leaf picking. The wild varieties of Assam, however, sometimes are as much as 15 or 20 feet high. The plant reaches its full bearing capacity in its fifth year, but in China leaves are plucked at the end of the third. The leaf, when full grown, is from 3 to 4 inches long in China; in Assam it will grow to 9 inches, if left to mature.

The leaves are picked three or four times a year in China—



[Photo: Messrs. Plate, Ltd.]

TEA PICKING ON A CEYLON PLANTATION

As many as sixteen pickings are made in the year. The leaves, when gathered, are withered, dried,

in April, May and July, and sometimes in August. In Assam the leaves sprout, or flush, oftener, and from ten to sixteen pickings are made; in Ceylon as many or even more are made. The leaves, when gathered, are withered, dried, rolled, and partly fermented; then they are dried again, and sorted. The work in India is done by machinery. In China much of it is still done by hand.

Green tea is not fermented.

"Brick" tea has been sent from China overland into Tibet, Turkestan and Russia for centuries. This is made by cutting long twigs from the plant with the leaves on, drying them, chopping them up, stem, buds and leaves together, sticking the lot with rice paste, and then compressing it into solid "bricks."

The chief tea-growing countries now are British India (in Assam and on the Nilgiri Hills in southern India), Ceylon, China, Japan, Java and Formosa. Ceylon plantations are the most productive, but Formosa exports the highest grade tea.

Tea is grown in small amounts in the U.S.A., Nyasaland, Natal, Jamaica and Brazil.

Outside the tea-drinking eastern world, the English-speaking peoples are the largest tea consumers. In Great Britain, which buys nearly half the tea exported, $6\frac{1}{2}$ pounds per head is drunk annually, and London is the world's biggest teastreet. Russia, the U.S.A. and Holland rank next after Great Britain in tea drinking. Much of the U.S.A. tea supply is green tea, got from Japan.

India has produced in a year nearly as much as 500 million pounds. Ceylon produces about half that quantity. How much is grown in China it is not possible to say. Java grows about half as much as Ceylon.

Maté. In South America, *maté*, or Paraguay tea, made from the leaves of the *yerba-maté*, a kind of holly which grows wild in Paraguay, Argentina, and southern Brazil, is very widely used. It is estimated that more than 10 million people in South America use *maté* regularly.

France imports *maté* powder in increasing quantities.

The *maté* branches are lopped off and then dried until the leaves will crumble into a powder. This powder is packed in skins; and the drink is prepared by putting some in a gourd

over which boiling water is poured. The liquid is sucked up through a reed, or strong straw, or silver tube, and is very refreshing in hot weather. Jerked beef and maté are the commonest food and drink on the big ranches of South America.

Coffee. It would seem that coffee drinking originated in Abyssinia, where the coffee tree grows wild. From Abyssinia the practice was carried across the Red Sea into Arabia; and the Arabs introduced it to the Turks of Constantinople. Thence it spread to western Europe. For a time after its introduction into England (1652) coffee-houses were all the rage in London. Later, tea drinking took the place of coffee drinking in England to a great extent.

The Dutch tried growing the coffee plant in Java and other of their East Indian settlements in the 17th century. Its cultivation then spread to the West Indies and to Central America. Later it was tried in Brazil, which is now the chief exporting country. In the newer British lands of Central Africa—Kenya, Tanganyika and Nyassaland—coffee growing has been fairly successful, but a period of over-production has spoilt the chances of very great success. Some coffee is grown in India. Ceylon once promised to be the greatest coffee producer in the world, but in the later years of the 19th century a fungus disease killed off most of the trees.

The beverage is made from the pulverized, or ground, product of the coffee-bean, the seed of a plant, or tree, which will grow to a height of nearly 30 feet in subtropical or tropical lands. On plantations the tree is pruned down to from three to eight feet to make berry gathering easier. It takes six years before it gives a full crop.

The beans are encased in dark, cherry-red, pulpy berries. Each berry generally holds two beans. The flowers are tubular in shape and very fragrant. The plant carries flowers, green and ripe berries at the same time. So careful gathering is necessary to ensure good quality coffee.

The plant is rather exacting in its requirements as to soil and climate. It is not so hardy as tea, and it needs from 70 to 120 inches of rain a year. The soil, moreover, must be well drained. The temperature average of the coldest month should be well over 40°. Any continued frost is fatal.

This limits coffee growing to the tropics or to the warm tropic edges. Yet young coffee plants, while liking warm weather, cannot bear the full blazing heat of a tropic sun. Banana trees are often used to provide them with shade. On some plantations in Brazil a tall hardy pea is cultivated for this purpose.

This serves also to enrich the ground with the nitrogen which the pea, like other legumes, takes from the air.

Virgin forest soils on tropical hills facing the sea are good for coffee growing; an elevation of 600 to 2,500 feet in Brazil, and of 2,000 to 3,000 or 4,000 feet in hotter Java being best.

Soils impregnated with iron improve both the quantity and quality of the yield.

Yemen, in Arabia, though at the corner of an arid, half-desert country, long supplied the best coffee in the world. There a rising mist from the warm tropic seas to the south and east gives the necessary moisture, and at midday affords shade. Mocha coffee from Yemen reaches Aden by caravan and is shipped from there. Aden also exports large quantities of coffee from Abyssinia. Some of this is still picked from the wild trees.

Brazil exports nearly 70 per cent. of the world's total, over 1,700 million pounds out of about 2,500 million. Colombia comes next; and the hill-sides of all the tropic parts of South and Central America are more or less given up to coffee. Jamaica exports fine Blue Mountain coffee. Where coffee is grown in moister lowland regions, Liberian coffee, a variety native to West Africa, is cultivated as it is more resistant to the fungoid trouble which ruined the Ceylon plantations.

The U.S.A. is the largest coffee importer; its people consume about 12 pounds per head each year. The Dutch come next, and obtain most of their coffee from Java. The people of



COFFEE-LANDS OF BRAZIL

Great Britain use only about $2\frac{1}{2}$ pounds per head, less than is consumed in any other country of western Europe.

Cocoa. Cocoa and chocolate are prepared from the dried beans, or seeds, of the cacao tree. The beans grow in large pods which hang direct from the stem of the tree, not from twigs or branches.

The cacao tree is *not* a relation either of the coco-nut palm, or the coca-shrub from which cocaine is obtained. It is a native of tropical America, and grows wild in the Amazon and Orinoco valleys, also in parts of lowland Mexico. The Aztecs of Mexico used the dried beans as a kind of money.

The Spaniards introduced the use of cocoa into Europe ; and Spain still uses cocoa as a drink more than any other European country, though, owing to the popularity of chocolates, Great Britain uses more per head than any other country in Europe or America.

The cacao tree needs a hot, moist, equable climate, with a rainfall well distributed throughout the year ; and it should



Photo : Messrs. Plale, Ltd.

PACKING COCOA FOR EXPORT

on a plantation in Ceylon. Cocoa beans are obtained from the cacao tree, which is *not* a relative of the coco-nut palm (see p. 73) or of the coca-shrub (see p. 97).

be grown where there is little or no wind to break off the heavy pods. The true equatorial climate at low levels, some 15° on each side of the Equator, satisfies these requirements. The West Indies, being exposed to hurricanes, are not satisfactory, except in the sheltered valleys of the more rugged islands; level islands, like Trinidad, being exposed to the steady trade winds, do not grow cacao trees.

If grown in rich, deep soil, and shaded from the sun at mid-day, the trees will reach a height of nearly 40 feet and will begin bearing fruit after three years, but a full crop is not obtained until after twelve. The tree will go on bearing till it is thirty years old; after that its yield will diminish.

Cocoa has the same stimulating properties as have tea and coffee, but it contains constituents which make it a food as well as a drink. The whole powdered cocoa is drunk, not left behind, like the tea leaves and coffee grains.

Climatic reasons make the cultivation of cocoa difficult for the white man; the hot, heavy, miasmatic air of the tropical lowlands does not agree with him. Nevertheless, the production of cocoa has greatly increased since the beginning of the 20th century.

At one time Ecuador, Brazil, Venezuela, Trinidad, and Dominica, in America, and São Thomé, a small island in the Gulf of Guinea, off the coast of Africa, were the chief producers. Now they are surpassed by the Gold Coast and Nigeria, in West Africa, which together export half the world's total. The annual value of the West African export has increased from only £5 to £8 million yearly since the beginning of the present century. A considerable quantity is also exported from Ceylon.

EXERCISES

1. Why do people in the Mediterranean regions drink fruit-juices rather than water?
2. Describe the tea-plant and its needs.
3. Draw a map showing the coffee region of Brazil.
4. What sort of weather is suited to the grape vine?
5. What is meant by maté? Where is it grown?
6. Describe the cacao tree and its uses.

XIII. SUGAR, SPICES AND TOBACCO

To sweeten their food, the early Nordic races had to be content with the honey made by their own bees. Sugar was to them unknown.

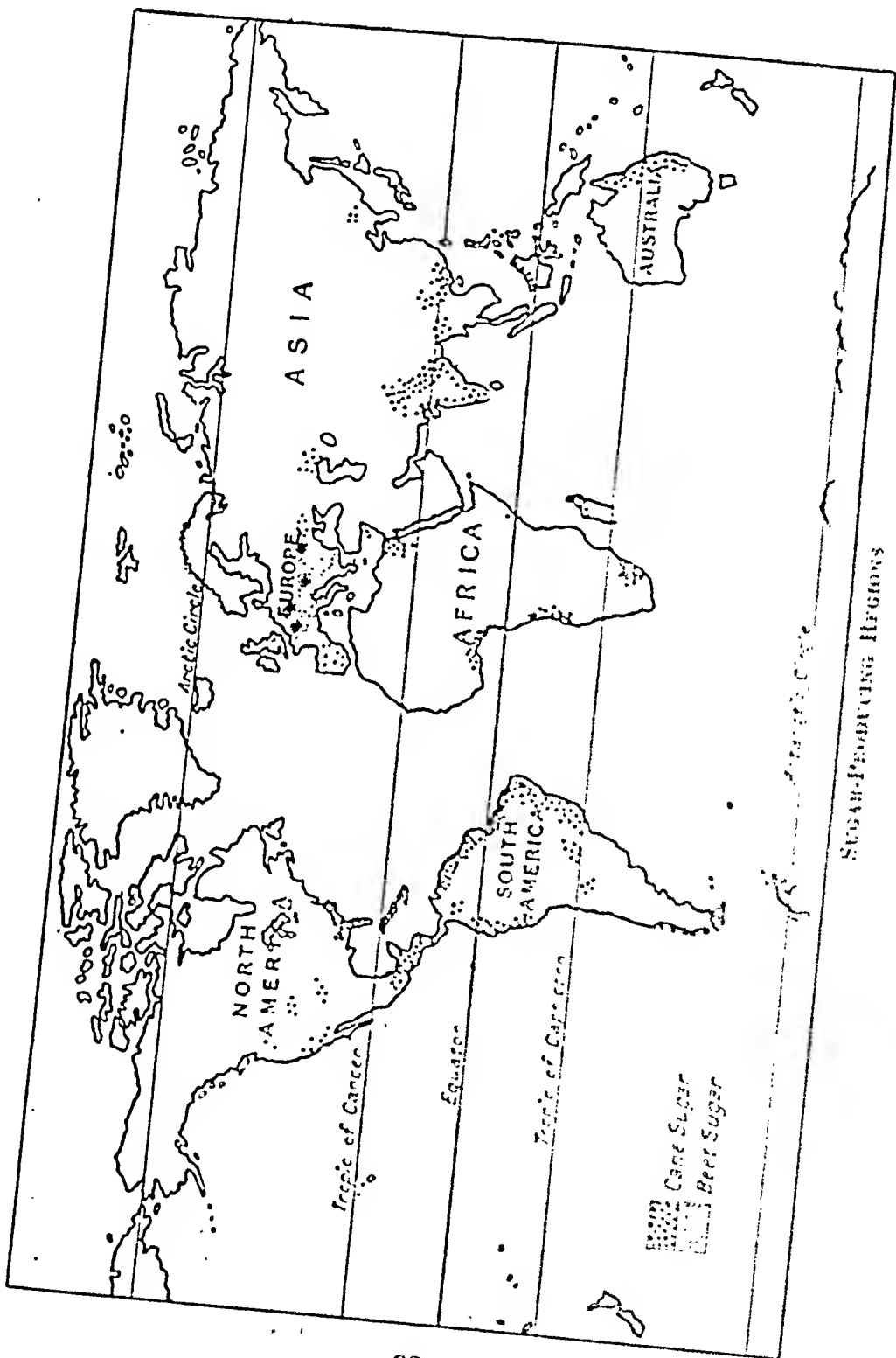
Bees are still largely kept in Germany, France and Italy for their honey and for the beeswax of the honeycomb. Italy exports honey, but has to import much wax, for the making of candles required for religious services. The extra honey needed nowadays in Europe is mostly imported from America; bees were introduced into that continent by the early European colonists who went from Spain to Mexico.

Starch and honey may not seem to the taste to have much in common; and to the average palate starch and sugar are hardly more alike. Yet starch and sugar are very much alike in their chemical composition. Sugar contains one atom more of water in each molecule than starch; otherwise they *are* alike. Many plants first turn their food into a form of sugar and then later store up that sugar in more compact stable form by taking out one tiny drop of water and leaving the store of food as starch.

The sugar-cane and sugar-beet are the two principal plants from which sugar is extracted. After them come the maple tree, a native of North America, the *sorghum* (a kind of millet), and maize. In tropical lands, various palms—the Indian date palm, the coco-nut palm, the toddy palm, and the sago palm—are used. Attempts also have been made to get sugar from grapes in quantities sufficient to render the extraction a commercial success.

Cane Sugar. The sugar-cane is a thick-stemmed grass; it grows to a height of 10 to 15 feet, and has reedy stalks which often are more than an inch thick. The juice is contained in the stem. The seeds, unlike those of other cereals, are of little use. The stalks are cut down each year just before they flower, but the root throws up fresh ratoons, or stems, the next year, and for perhaps as many as thirty years after, though with a steadily lessening sugar content.

The cane is a tropic plant. It flourishes in hot, wet lowlands, facing the sea, and requires a rainfall of over 40 inches a year, no





CUTTING SUGAR CANES

on a plantation in Natal. The cane is a tropical plant and flourishes in hot and wet lowlands.

frost, and a temperature of 80° or more in the warmest month. If grown in a warm, wet summer land, which has winter frosts, the cane must be replanted each spring, for the old root dies in the cold. In the northern hemisphere it can be grown as far north as 37° (in Spain), and in the southern as far south as 30° (in Natal and New South Wales).

In the year 1700 Europe used some 50,000 tons of sugar. This amount would now last the U.S.A. about $3\frac{1}{2}$ days. Cuba alone exports 2 million tons each year, and the Dutch East Indies nearly 1 million tons.

The West Indies were highly prized in the days when sugar was a rarity, and the sugar-cane the only plant producing it in commercial quantities. The plantations were worked by slave labour, and sugar-rum and molasses bulked largely in the exports of each island. The prosperity of the islands suffered when beet-sugar became commercially important.

In the old days the leaves were stripped off the canes, and

the stalks were then cut down and carried on mule-back to be crushed at the sugar mill. There the juice was boiled in open cauldrons, and the coarse, unrefined sugar was afterwards exported. Much of the sweet syrup remained behind as molasses. Nowadays the canes are crushed by machinery, the engines being fed by the refuse of the crushed cane. The liquid remaining after the boiling is tasteless stuff of little use for exporting to make golden syrup or treacle; that needs to be got from older mills.

Some of the crushed cane is ground and mixed with molasses to make cattle food. Industrial alcohol is distilled from the roller-crushed molasses by-product; and some of the cane is made into a kind of paper.

British Guiana, in South America, is famous for its Demerara sugar. There the canes are grown upon the embanked coastal plains thrown up by the tides and washed down by the rivers. These lowlands are so unhealthy for white men that coolies have been introduced from India to work the plantations. The coolies now number over 100,000.

Of the cane-sugar importing countries the U.S.A. and Great Britain are the chief. The U.S.A. gets supplies chiefly from Cuba, Porto Rico and Hawaii; Great Britain from Cuba, Jamaica, British Guiana, Mauritius and Java. India produces over 3 million tons, but also imports from Java.

Beet-Sugar. The difficulty of getting supplies of sugar in Europe during the Napoleonic wars turned attention to beet growing, German scientists having shown how sugar might be extracted and the sugar content of the beetroot increased.

The sugar-beet, the table-beet, and the mangold-wurzel, which is fed to cattle and horses, are said to be descendants of the same plant—a plant found growing wild over southern Europe. Sugar-beet requires well-drained, fertile, deep, loamy soils, rich in lime. Deep ploughing is also needed, and steady manuring, for the beetroot, like the sugar-cane, is an exhausting crop.

To ensure a good crop, there should be fairly heavy rains in spring and early summer, warm, but not hot, summers, and cool, dry autumns. Long hours of daylight are needed, too; this increases the amount of sugar formed in the roots.

The European areas of beet cultivation stretch from northern France across Belgium, Holland, Germany and Poland into Russia. Some is now cultivated in East Anglia. England, in fact, having for years imported from £20 to £25 million worth annually, is at last trying to produce some of the sugar she needs. In the U.S.A. nearly a million tons of beet-sugar are produced each year.

Spices. Spices are not food, but their world-wide use makes them important in commerce. They are all, or nearly all, products of tropical lands. In the early days of commerce they were of even more importance than now, for they served to flavour food that was often so stale and monotonous as to be almost uneatable. Further, they were of small bulk compared with their value when once in western markets, and so possible of transportation in days of wind-blown trade oversea, and of caravan and mule-back carriage overland.

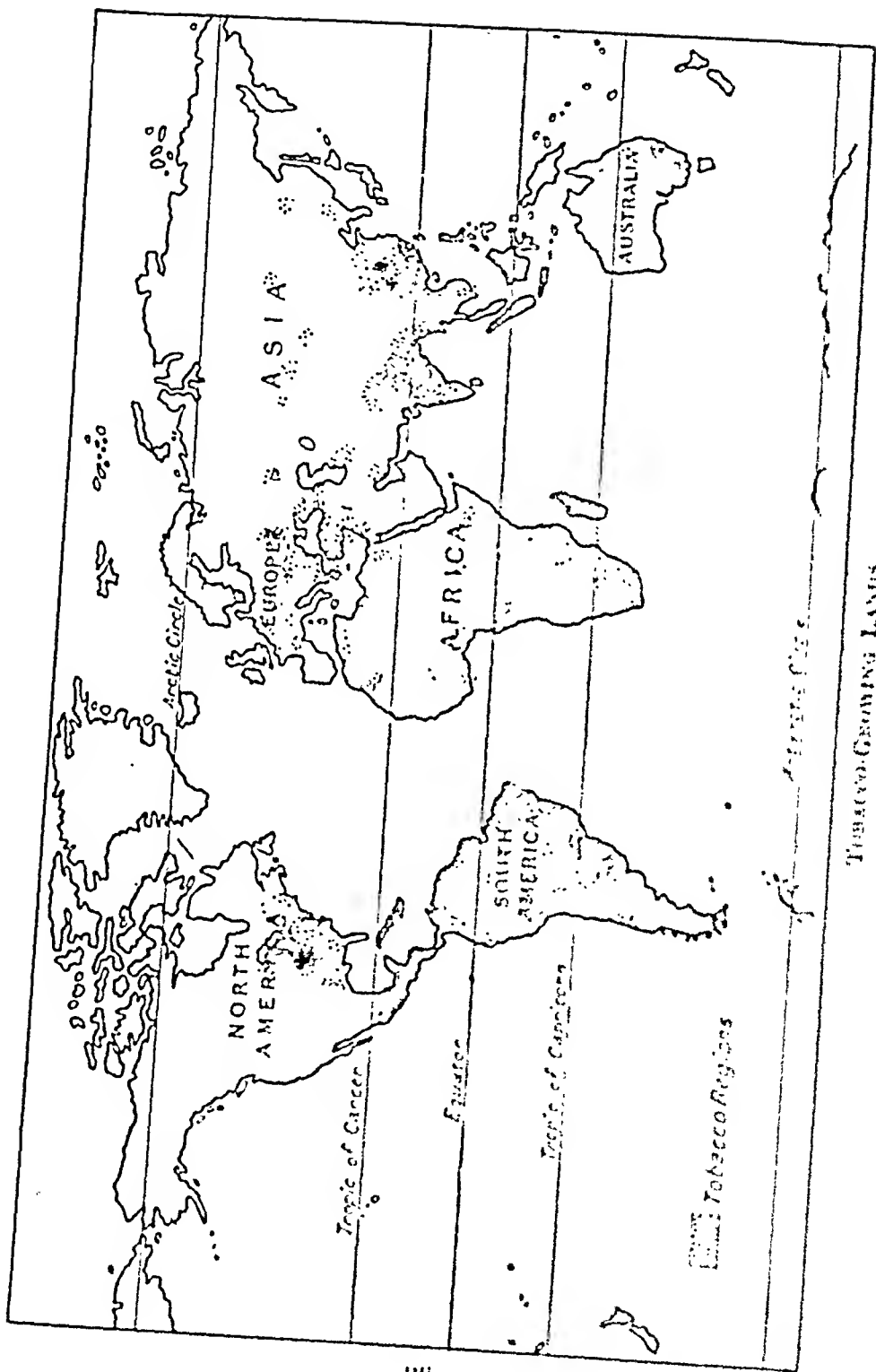
Profits on successful ventures in those days were large. Pepper worth 4*d.* a pound in the East Indies was worth 20*d.* a pound when it reached England.

Pepper, the most important of the spices, is exported mostly from Singapore. There it is assembled from the local plantations and from Java, Sumatra, Borneo and Siam. The Malabar Coast of India also grows pepper.

Peppercorns, black pepper and white pepper all come from the same plant—a kind of climbing and twining vine. Peppercorns are the whole seed; black pepper is the ground seed, including the skin; white pepper is the same seed, riper, with the skin off. Ninety per cent. of the pepper used in Great Britain comes from Singapore and the Straits Settlements.

Cayenne Pepper and *Chillies* are the seeds, ground or whole, of a different plant—native to South America but now grown in many tropic lands. This pepper is named after Cayenne in French Guiana. Chillies, the pods of one variety of this plant, can be grown in Spain and Hungary; they are used mainly in pickling.

Ginger is the second most important spice. It is the dried, underground stem of a reed-like plant that grows wild in south-eastern Asia. The root is now widely cultivated. Most of the ginger used in Great Britain is exported from the British



East and West Indies and from Sierra-Leone. Some ginger is now grown in Queensland.

Cinnamon is the dried bark from the young shoots of an evergreen tree which is grown chiefly in Ceylon and the southern parts of India.

Nutmegs and *Mace* are products of the Moluccas, or Spice Islands, in the East Indies. The nutmeg is the peeled fruit of the tree ; mace is the outer skin of the fruit. Singapore and Penang, a small island in the Straits Settlements, are both large growers nowadays.

Cloves are the dried, unopened flower buds of a tree which is now grown largely in Zanzibar. The production is in the hands chiefly of Arabs. Some cloves are exported from the East Indies.

Stimulants. There are times when men wish to solace themselves after eating ; there are others when, jaded or hungry, they wish to spur themselves on to effort. This they do by means of stimulants, until at length indulgence in stimulants grows into a habit. Some stimulants are intoxicating drinks ; others are vegetable solids to be chewed or smoked.

Kola-nuts, which contain caffeine, are chewed in tropical Africa and are now grown in the New World. The *Betel*, which is something like the pepper tree, produces nuts and leaves, both of which are chewed in the East Indies. Betel leaves mixed with areca-nut forms a favourite stimulant chewing mixture in India.

Coca leaves, the leaves of the coca-shrub, a native of the east side of the tropical Andes, give to him who chews them a quite extraordinary power of enduring fatigue. From them is prepared *cocaine*, the "white snow" of an illicit drug traffic. Habitual use of cocaine is ruinous to the human body.

The two best-known stimulants of vegetable form are tobacco and opium. *Opium* is the hardened juice of a kind of poppy which is believed to be a development of a wild species found growing around the Mediterranean. Its use and cultivation have been common in India for nearly 3,000 years. The seed vessel of the poppy is scratched, and the juice, as it oozes out and hardens, is scraped off. This solidified juice is either swallowed in small quantities, smoked, or dissolved and drunk. Used medicinally it is of great value in the form of *morphia*, or as *laudanum*.

Tobacco. Columbus and other European discoverers found tobacco in use in America. It is now used in all lands from the frozen Arctic wastes to Equatorial lands. The nicotine in tobacco is an active poison, capable of most injurious effects upon immature bodies, but it acts as a sedative and nerve-soother in older people. Modern science has shown how solutions of tobacco may be used as spray, for exterminating noxious insects. Tobacco waste is useful as a potato fertilizer on tired, worn-out fields; a good sheep-wash is also prepared from tobacco.

In the U.S.A. over 10 pounds of tobacco is consumed per head per year; in Holland $6\frac{1}{2}$ pounds; in Germany nearly $4\frac{1}{2}$ pounds; in Great Britain nearly 4 pounds; and in France 3 pounds. The use of cigarettes increased in the U.S.A. from about 18 billion in 1913 to over 60 billion a year in 1924.

There are many varieties of tobacco. The variety most generally cultivated grows from 4 to 6 feet high and carries several clusters of pink or white flowers. The plant can be grown anywhere in the tropics, and as far north as Scotland, but it must be protected from frost. The quality of the soil and differences in temperature and humidity of the air affect the quality and flavour of the leaf to a remarkable extent. The care of, and manner of curing, the leaf also have a great influence upon the commercial product.

The U.S.A. produces more tobacco than any other country. Next comes British India. Indian tobacco, however, is generally of poor quality. Russia is the third largest producer; whilst Cuba and the Philippines specialize in good-quality tobaccos. Cuban or Habana cigars are specially noted. Hungary, Italy, Bulgaria, Germany and Greece all grow tobacco.

EXERCISES

1. Draw a map to show the chief cane-sugar lands of the world.
2. Why is beetroot growing on the increase in Europe?
3. Why in early times were the people of Western Europe interested in (a) trade with the East and (b) the West Indies?
4. What is opium? Where is it grown? Why has the Chinese Government tried to stop its import?
5. Which are the chief tobacco-producing countries? What are the properties and uses of tobacco?

XIV. FURS, HIDES AND LEATHER

In addition to food and drink, man needs shelter—somewhere to hide and sleep in, and something to protect his body from the chances and changes of a variable climate. Even early pastoral man learnt to make himself a skin covering which he wrapped round his body. He also learnt to stick up a stretched hide between himself and the wind. This, later, grew into a portable tent.

Some articles are worn for decoration, not for protection. Others are worn out of boastful pride, or as a “tabu,” or as a spiritual protection from unknown evils. All such wearing led, and leads, to trade. The Cavalier’s feathered hat, for example, if reintroduced, would greatly aid South African ostrich farming. Cape Colony at the beginning of the 20th century had 750,000 ostriches. Now, owing to changed fashions, barely 250,000 are kept.

Furs. Man and woman still wear skins. But the softer skins have become, in most cases, fur coats and wraps for ladies, or for the Arctic Eskimo; and the harder hides have been tanned to become leather for the feet.

Most of the furs that women wear are the coverings of wild animals which live in the Arctic and cooler temperate lands—in the great belt of coniferous forest which stretches across the world from Alaska to Labrador, and from Norway to far eastern Siberia; in the southern polar regions there is very little forested land.

The fur trade of North America was for a long time a monopoly of the Hudson Bay Company (founded in 1670). Wandering trappers—Red Indian and whites—then went forth into the wilderness in search of skins, or “pelts,” which they sold at the Company’s stations.

Many kinds of fur are obtained in North America—sable, black or silver fox, beaver, mink, otter, musk-rat and squirrel, sable being the most valuable. Ermine, a much sought fur, is found only in Europe and Siberia. Nowadays the skins of hares and rabbits, exported mostly from Australia and New Zealand, are “worked up” to make less expensive coats and wraps. Nutria skins are exported from Argentina; and the fur seal is caught in Bering Strait.

The world fur markets are at St. Louis, in the U.S.A.; at Leipzig, in Germany; at Nishni-Novgorod, in Russia, and at London. The trade of Leipzig and Nishni-Novgorod has been much disorganized since the Great War (1914-18).

Of late years the number of wild animal, has lessened greatly, owing to keener trapping and the destruction of cover. This has led to a new development fur farming, which began in Prince Edward Island, Canada. There black and silver foxes are reared in captivity, and their skins sold. Fox, skunk, musk-rat, opossum and mink also are now reared in the U.S.A. and Canada.

Rabbits and hares provide material for felting. Many of the hats men wear to-day are made from the skins of Australian rabbits. "Top-hats" are generally made from beaver skins.

Hides and Skins. Many animal have tough outer coverings suitable for making into some form of leather. Hides and skins, however, are provided mostly by the domestic animals - the horse, ox, sheep, goat and pig. "Hide" usually denotes the outer coverings of cattle and horses, and "skin" the outer covering of sheep, goats or pigs. It is difficult to "cure" pork after the skin has been removed. Pigskin, therefore, is not so commonly used as it might otherwise be.

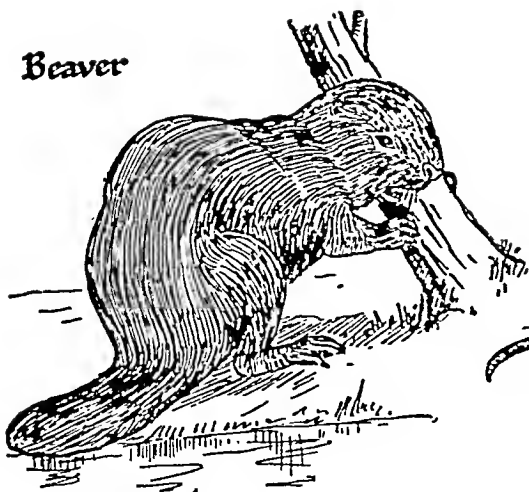
India, where oxen are much used as draught animals, was at one time the chief exporter of hides; now the country exports more leather. Argentina sends many hides abroad. So, too, does Italy. Sheepskins are obtained from Australia, New Zealand, South Africa and the Argentine; goat skins from drier, hilly Mediterranean lands and from parts of China and Brazil.

The U.S.A. consumes all its own hides. Others, moreover, are imported - from Canada and from almost every state in Central and South America.

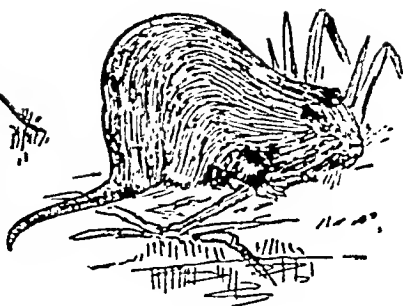
Hides and skins are particularly easy to export from undeveloped countries with wide ranches; dried and salted, they are proof against rain, dirt and sun, and they can be transported over rough roads in bales of any shape, or stowed away anywhere in ships' holds.

The goat is able to live on the scantiest pastures, up the mountain side, or on the desert edge. There are said to be

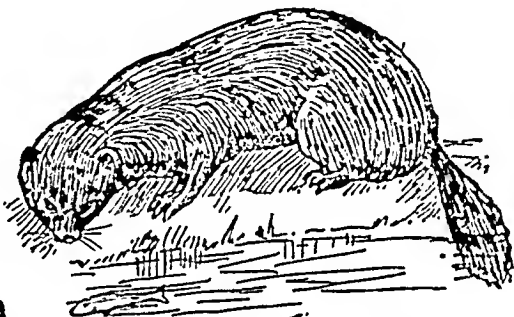
Beaver



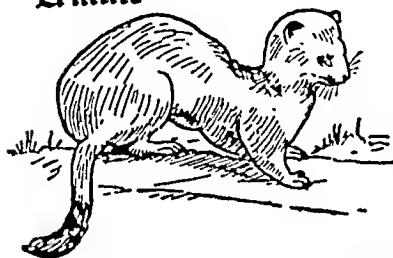
Coypu



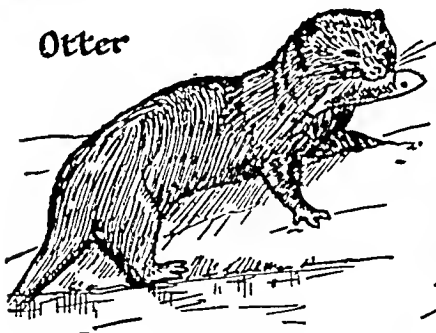
Mink



Ermine



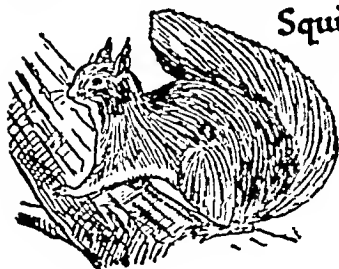
Otter



Sable



Squirrel



Black or Silver Fox



FUR-BEARING ANIMALS

Keen trapping has greatly reduced the number of wild animals. This has led to the development of fur farming as an industry.

100 million goats in the world. Some are kept almost entirely for their skins, and these are reared on the world's worst pastures. Spain, Nigeria and Algeria have some 4 million each, Brazil probably has as many, and British India has 24 million. Skins are sent overland, by caravan, from China and Mongolia across the vast central Asian desert.

The Angora goat of Asia Minor is valuable for its mohair, rather than its skin.

Leather. The changing of the soft hides and skins into a tough, durable leather is an important manufacturing process. The old way of doing it was to steep hides in pits containing alternate layers of hides and oak-bark, and to leave the "tannin" in the oak to do the necessary work. This method, once extensively employed in many small market towns throughout England, made excellent oak-tanned cow-leather. But oak trees grow slowly, and the demand for leather rapidly increased. So other methods had to be found.

Several vegetable substances contain "tannin". Tea is one; but tea is too valuable to be used for tanning. Others are birch bark, hemlock spruce bark from Canada, valonia-male from acorn cups in the Levant, acacia bark from Natal, black wattle bark from Australia, and quebracho wood from the Parana-Paraguay basin. All these substances have been used for making leather, but now the practice of growing or extracting the "tannin," or tannin acid, where the wood is grown, and exporting that, in order to save cost of transport. Chestnut extract and quebracho extract are imported in large quantities into Great Britain.

Cutch and gambier are also imported. Cutch is got from the soaked wood of an acacia, or from mangrove. Gambier is got from the leaves of a shrub which grows in Malaya and the East Indies. One ton of gambier extract will tan as much as 6 tons of oak-bark.

Germany, France and Great Britain are all large leather-producers. Germany makes coloured leathers; France is pre-eminent in glove-making, also in the making of patent leathers. Great Britain, though she imports more leather goods than she exports, is specially noted for good boots and shoes, harness and saddlery. Much of the harness is made from pigskin.

The U.S.A. imports special varieties of leather from Europe worth some £3 million yearly, but exports of her own supplies nearly £10 million yearly. Nearly a quarter million people in the States are employed manufacturing boots and shoes in factories. They make about 300 million pairs a year and export some 10 million.

Russia is noted for a leather saturated with birch-bark oil that boot-destroying insects dislike. Morocco has for long years exported a leather made from goatskin.

EXERCISES

1. Why did leather tanning grow up in the river valleys of England?
2. Why were trading companies established to trade with frozen Arctic lands?
3. Why are foxes bred and reared in Prince Edward Island?
4. What is meant by (a) "Morocco" leather and (b) "Russian" leather?
5. Why are the "quebracho" forests of the Parana-Paraguay basin of importance nowadays?

XV. WOOL AND SILK

Wool was originally the undercoat of the sheep. As a result of long breeding and selection, the woolly undercoat has now become the chief coat, though in hot countries the true hair tends to predominate.

Wool is distinguished from ordinary hair by being crinkly, and by being covered with very small scales which overlap each other, like the scales of a fish. When the natural grease on the wool has been scoured off, these scales catch each other and hold the wool together in a tangled mass which can be beaten into what is known as "felt." The crimp, or curl, causes cloth woven of wool to be elastic, and so to differ from cotton- or flax-woven products.

Sheep may be reared either for their mutton or for their wool. Mutton sheep generally require a damper climate and better pasture than sheep bred for wool alone. Efforts are being made in many sheep areas to raise a variety which will be good for both mutton and wool.

The wool sheep can exist on the herbage which grows wherever the rainfall is over 10 inches per year. Where the rainfall exceeds 30 inches, the ground becomes too damp, and foot-rot

and other troubles ensue. Dry-land sheep, however, tend to decline physically. It is necessary, therefore, to strengthen their stock from time to time by importations from cooler and wetter regions.

Merino. The southern temperate grass-lands are in some respects better than the northern for raising sheep for wool; the northern lands in many parts are too cold in winter. The Mediterranean countries possess a grassy tract, peculiarly suitable,



A Merino Sheep

Merino wool, very long and of unequalled softness and lustre, is produced largely in Victoria and New South Wales.

Spain was noted for its fleeces in Roman times, but, owing to a long neglect of sheep rearing, Spanish wool is now surpassed by merino wool from the Antipodes.

English wool was for a long time imported into Flanders for making cloth; and some special varieties are still exported to other countries. Nowadays, however, the cloth manufacture of the British Isles demands the importation of enormous quantities of wool.

Sheep-breeding for wool is the principal pastoral industry in Australia. Merino wool, very long in staple and of unequalled softness and lustre, is produced in Victoria and New South Wales. The sheep in Australia have numbered as many

as 100 million, but recurrent droughts do much damage; the number at times does not exceed 50 million. Ninety per cent. of the wool is exported—mainly to England.

The merino sheep gives but poor mutton. The increase in the demand for frozen mutton has led, therefore, to the breeding of sheep suited for both mutton and wool. This also has been done in South Africa, where an older fat-tailed sheep has been interbred with imported merinos and English sheep. Australia has, roughly, 75 million sheep; South Africa, 30 million; and New Zealand, 25 million. Argentina and Brazil have about 5 million each.

Oriental Carpets. The wools of Asia are, for the most part, poor in quality; they may be classed as "carpet" wools. China and Mongolia export large quantities of these coarse wools. South Russia, Turkey and Scotland also export some.

The wools of Asia may not be suited for high-class cloth manufacture, but, since dyeing and hand-made weaving have been brought to perfection in sheep-rearing Asiatic lands, Persian rugs, Turkey and Indian carpets, and some Chinese carpets, are of unsurpassable quality.

The best carpets have a strong web of hemp or linen running through them.



ANGORA GOATS,

natives of Angora in the central plateau of Asia Minor, produce mohair of remarkably fine quality.

Mohair, Alpaca, Camel's Hair, etc. Certain animals—the goat, the alpaca, the llama, the vicuña and the camel—have coverings which in their qualities partly resemble wool and partly hair. The Angora goat, a native of the steppe-lands of the interior of Asia Minor, produces *mohair*, of remarkable length, fineness and softness, and of silky appearance. This goat has now been introduced into South Africa; and from the dry Karroo, which is too arid for sheep, some 8 million pounds of mohair are exported yearly. Similarly, in the U.S.A., particularly in Texas, there is dry pasturage which is better suited to goats than to sheep.

The Cashmere goat has, under its outer coat, a fine downy under-covering which grows in winter and is the basis of the world-renowned *Cashmere shawl*. Other animals, like the yak which lives on the lofty Himalayas, have a similar winter coat. *Alpaca*, *llama*, and *vicuña* are words produced by animals which belong to the lofty plateau of the Andes. The alpaca was domesticated by the Peruvians in Inca days, and its wool hand-spun. For long it could not be manufactured by modern machinery; the difficulties, finally, were overcome at Bradford in the middle of the 19th century.

The llama is similar to the alpaca. The vicuña, however, inhabits regions over 13,000 feet above sea-level. Man cannot live permanently at such heights. So the vicuña has not been domesticated, and its wool supply, in consequence, though of very good quality, is very small.

Camel's hair was once used in Great Britain only for making brushes. Now it is also made into blankets, carpets, shawls and other things.

Woollen Manufacture. In all temperate countries, with the exception of China and Japan, wool is the principal clothing material used. It is a bad conductor of heat. The body heat, therefore, is kept in the body by woollen clothes; and, since sweat passes more readily through woollen fibres than through cotton or linen, woollen clothes lessen the risk of chills being caused by dampness of the body covering after strenuous exertion.

Before it can be woven, the greasy wool of the sheep has to be scoured. Unless this was done, the grease would prevent the fibre taking dyes.

temperature, with the wool the principal clothing of the body, heat, and cold, and, since sweat is absorbed through cotton or wool, the being caused by the enormous exertion. The wool of the sheep has the grease would prevent



Top : preparing wool for worsted materials. *Bottom* : scouring machines which remove grease from the wool.

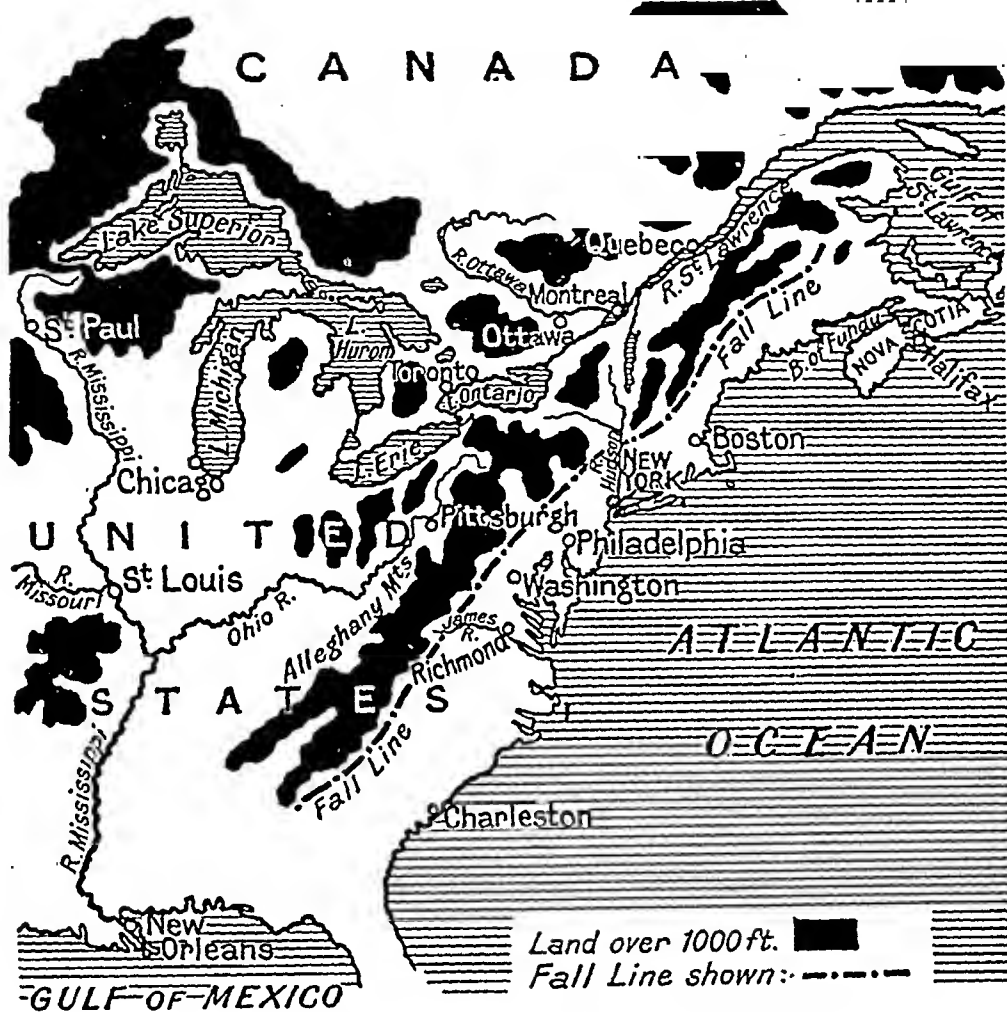


THE WEST RIVER OF YUNNAN

Scouring reduces by about half the weight of a lot of wool. At one time the grease was regarded as waste. Now it is utilized in making soap—soap to secure fresh supplies of wool, and even toilet soap.

The wool, having been scoured, goes through various other processes—combing, carding, etc.—before it is spun into yarn for weaving cloth. *Worsted*, said to have been named after Worsted, in Norfolk, are cloths in which the separate threads can be seen. *Woollen* or *Blanket* cloths are “milled,” or “teazled,” so that the individual threads are invisible.

Sometimes “woollen” is used of a cloth which has cotton or other threads running one way, and “all wool” is used to mean a cloth material made completely of wool. “Shoddy” is cloth made from old materials torn up, re-spun and re-woven. The cloth thus made is thick and warm, but not very durable.



THE MANUFACTURING AREA OF THE U.S.A.

A quarter of a million people are engaged in wool manufacture in England. The old cottage industry of the West Riding of Yorkshire has grown into the machine and factory industry centred at Bradford, Leeds and Huddersfield, where are made the best and finest cloths in the world.

On the continent of Europe the woollen industry still clings to the places where of old sheep were pastured. In the valleys of the Upper Danube, the Elbe, the Rhine and the Seine, and, more particularly, in Silesia, Saxony and Westphalia, modern cloths are made in progressive and up-to-date factories.

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RT

along the Fall Line. There water-power ran the machinery, new in the early 19th century, just as the Ouse and its tributaries supplied the power in the West Riding of Yorkshire, until steam came into general use. Philadelphia is now the centre of woollen manufacture in the States. The American production is worth nearly £700 million a year.

The estimated production of wool in the world annually is 3 billion pounds. For a time after the Great War (1914-18) the demand outran the supply. This was due partly to an increasing call in China and Japan for woollen cloths of the western kind.

Silkworms. Silk is a clothing substance which ranks next in importance to wool, though it must be remembered that cotton nowadays is of much greater commercial value than either.

Silk is the fibre spun by the silkworm, which is really a caterpillar, a creature in an intermediate stage between an egg and a chrysalis. The silkworm thrives best on the leaves of the white mulberry tree. It can be reared most easily, therefore, in a climate which is warm enough for the mulberry to produce two crops of leaves a year. This needs a temperature of 54.5° F. for over three months in the year. Roughly speaking, anywhere within the tropics with rain enough for trees, and anywhere within the temperate zone as far as the grape can be cultivated, is suitable.

The silkworm itself needs a temperature of over 60° F. It may sometimes be necessary, therefore, to keep the eggs and worms under glass, or in heated rooms.

The silkworm sends out from its head strands of jelly-like stuff which harden in the air, and, having wrapped itself completely in a cocoon of this hair-fine jelly thread, passes, after seven weeks as a caterpillar, into the coma, or sleep, of the chrysalis stage. Each cocoon is from $\frac{3}{4}$ inch to 1 inch long, and yields 300 to 500 yards of thread; but five or more threads must be twisted together to make one thread of spun silk.

Japan and China are now the chief exporters of raw silk. Italy comes next. The U.S.A., France and Switzerland are the chief importers. China is said to produce annually 2,000 million cocoons, giving 180 million pounds of raw silk.

The old handwoven silks of China and Japan were marvellously beautiful. Much of the material now produced is

cheap, machine-made stuff. The silks of Cipangu (Japan) and of China were one of the mainstays of the old caravan and sea trade between West and East; owing to their light weight, compared with their value, spun silk and silk materials could be carried half round the world without adding too greatly to the market price.

The U.S.A., now the greatest silk manufacturing country in the world, is able, by reason of this ease of transport, to import from Japan, China and Italy practically all the raw silk it requires. Most of the production, worth £150 million a year, is used within the States. Some, however, is exported. Paterson, in New Jersey, is the leading town in silk manufacture.

France surpasses all other European countries in silk manufacture. In the British Isles silk manufacture is not of outstanding importance, though the using of silk waste, the residue from cocoons, has grown up near the cotton and woollen districts, also in Warwickshire and London.

Artificial Silk. The silkworm takes a vegetable product, mulberry leaves and some varieties of oak leaves, and turns them into a jelly-like mass of cellulose inside its head, driving out the substance through two small holes in its head in thread-like form. Modern chemists have succeeded in producing a somewhat similar jelly from sawdust and cotton waste, and in making a machine that drives it in threads through minute holes in glass tubes. Used in conjunction with stronger fibres of wool and cotton, and dyed with a high lustre, obtained chemically from tin, this artificial silk has found a ready market.

The world production of artificial silk is now greater than that of the natural silkworm product; it reaches about 200 million pounds. Some 50 million pounds, or more, is made in the U.S.A., where stores of the raw materials, both wood and cotton waste, are very large.

EXERCISES

1. What is the most important wool-producing area in the world at the present day? Why is it particularly suitable for sheep?
2. Why do Mediterranean lands keep more goats than sheep?
3. Why are rugs and carpets well-known products of the steppes of Asia?
4. What is meant by mohair, alpaca, vicuna, and cashmere?
5. Why do certain Yorkshire towns make soap as well as cloth?

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XVI. COTTON AND OTHER VEGETABLE FIBRES

Herodotus (died 408 B.C.), the Greek historian, said that he had heard of a tree growing in India which bore wool like that of a sheep instead of fruit. According to old Indian records this "wool"—or, rather, cotton—was used in India as far back as twenty-seven centuries ago.

Cotton was first imported into England in the year 1298—for the making of candle-wicks. In those days people made their own candles by repeatedly dipping the wick into melted fat, which they allowed to harden around the wick after each dipping. Nowadays cotton, in some form or other, is used all over the world—from equatorial regions, through the hot and arid deserts, to the edges of the Polar wastes.

The cotton plant, or tree, grows wild in the tropics; and its cultivation is fairly common in all tropical and subtropical lands, though commercial production, in quantities suited to present-day needs, is limited to certain special areas. The U.S.A., India, Egypt and Brazil head the list of countries which export raw cotton. China ranks next to the U.S.A. and India as a producer, but most of the Chinese crop is used at home.

Roughly speaking, the world's cotton crop amounts to 19 million bales annually. Of this the U.S.A. supplies 10 million bales; India, $4\frac{1}{2}$ million; China, 2 million; and Egypt, $1\frac{1}{2}$ million.

The weight of a bale averages about 500 pounds. It varies, in fact, from 400 to 600 pounds, according to the kind of cotton it contains, and the exporting country.

The leading importing countries are Great Britain, Japan, Switzerland, France, Italy, Germany and Spain. The U.S.A. exports mostly through the Gulf ports of Galveston, New Orleans and Mobile.

The Cotton Plant. Though the cotton tree is a native of the tropics, the largest quantities of cotton are grown in subtropical regions; even the great Indian growing region, behind Bombay, is more than 1,000 feet above sea-level. The northern limit of growth runs along latitude 37° in the New World and as far as 40° or 42° in Turkestan, where summers are continental.

The two specially suitable areas are the Gulf states of North America and the southern China lands; in both the summers are monsoonal.

There are several varieties of the cotton plant. All, however, require a long, warm summer, and a growing period of nearly 200 days and nights free from "killing" frosts. The spring should be warm and mild, with frequent showers, and should be followed by a summer of temperatures ranging upwards from 74° F. to about 84° F. In summer, showers should be frequent, but the time between them should be sunny, with skies of clear and cloudless blue, if cotton of good quality is to be produced. The autumn ripening time should be long, dry and fairly cool. A total rainfall of 20 inches up to 40 inches is needed.

The raw cotton of commerce consists of the fibres surrounding the seeds of the plant. The flower lasts only a day or two; after the flower comes the boll, or fruit, about the size of a small apple. The boll bursts, showing seeds surrounded by a filmy, fluffy mass of a white, woolly-looking substance. Some two-thirds of the weight of the boll is seed; the other is lint, or cotton-wool.

The fibres of this lint vary in length according to the variety; those of the annual plant grown in the U.S.A. have an average length of about an inch. This plant was introduced into the States from the East. The best fibres, those of Sea Island cotton which grows in the West Indies and Georgia, are 1½ to 2½ inches long. Next to Sea Island cotton come the Egyptian cottons. The shortest and roughest are those of India; these are generally little more than ½ inch long.

Cotton Cultivation. The cultivation of cotton for commercial uses is a good illustration of how modern study of conditions can help to improve both the quantity and the quality of the crop. The wild cotton tree of the tropics will grow to a height of twenty feet and produce seeds and lint for twenty years. Yet the greatest cotton area of the world is not in the hot, wet lands, but in lands where frost kills off the cotton plant each winter; the plant seems to need a warning of approaching ruin and death to make it work its best in producing seed and lint.

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In the U.S.A. the planting is annual and the bush is pruned to 2 or 3 feet. The seeds are put in in rows about April, hoed and thinned, and hoed, or ploughed again, to keep the soil open and to prevent too much evaporation of moisture from the roots.

The bolls must be hand-picked. So cheap labour must be available; a satisfactory picking machine has not yet been invented. As the bottom bolls ripen first, the picking has to be done two or three times if a full crop is to be obtained.

The top bolls are liable to be spoiled by early autumn frosts. Nevertheless, since frost kills the boll-weevil, cotton cultivation is spreading northward to lands less secure from frost. Two good pickings of bolls free from weevil are more profitable than three where the weevil is prevalent. Similarly cotton growing is also spreading westward to the drier lands, where the rainfall is less than is necessary for a first-class crop, because the drier lands likewise are freer from boll-weevil. Texas, not the Atlantic coast and Mississippi main river States, is now the greatest cotton producer in the U.S.A.

Sea Island cotton growing, driven from Georgia by the weevil, is developing in the Salt River irrigated lands of Arizona in the Colorado Desert, around Phoenix—the region watered by the Roosevelt dam.

Black Cotton-Soil. The cotton growing of India is aided by the nature of the soil. The plant needs a warm, fertile soil, fairly deep and rich in lime. On the Deccan is a soil known as black cotton-soil, derived from the weathering of old basaltic rocks. It is very fertile and, in places, has grown cotton for hundreds of years without manure. This Deccan soil, though it dries on the top owing to the great heat following the monsoon rains, holds tenaciously within its clods and lumps the moisture it has received earlier. Thus irrigation is not needed, although the rainfall is scanty; the steep ascent of the Western Ghats traps most of the copious rain of the south-west monsoon.

In the Punjab, whither cotton growing is spreading, the land must be irrigated. In Egypt, too, irrigation is necessary. Egyptian cotton is remarkably good, but does not do well either in India or in Texas.

Empire Cotton. The fact that the world has long been dependent upon the U.S.A. for raw cotton has led to increasing efforts to develop the cotton possibilities in other lands and especially within the British Empire. The Anglo-Egyptian Sudan has many acres of land suitable in some ways, and all down the eastern side of Africa, in Uganda, Tanganyika and Rhodesia more or less successful efforts at cultivation have been made. Some cotton is also grown in Nigeria. Northern Queensland has grown for some years a hybrid between tree cotton and the Peruvian crinkly variety, but the difficulty of getting sufficient labour is a considerable handicap.

In central Asia, where the opening of railways was providing transport before the Russian revolution of 1917, the development of the old cotton lands of Samarkand, Bokhara, and other ancient irrigated areas, was for a time hindered by unsettled political conditions. Tashkent is the chief centre. Most of the raw cotton produced is sent into European Russia.

Cotton Manufacture. Cotton at one time was much more expensive as a clothing fabric than wool or linen. The picking out from the lint of the seeds, each about the size of a pea, was done by hand; and it was a long and costly process; it took a day to pick clean one or two pounds of cotton. In 1793, however, a cotton "gin" was invented. This pulled the fibres through a comb, leaving the seeds behind. Up to that time most of the British import had been from the West Indies and Brazil, where labour was plentiful and cheap. After the invention of the cotton gin, the greatest production of cotton shifted to the cotton belt of the U.S.A., where land was cheap. This made the southern states all the more anxious to retain their slaves, for cheap labour—to pick the cotton at harvest—was wanted.

The spinning and weaving machines invented by Englishmen in the later years of the 18th century, together with unlimited coal and iron resources, placed England in the forefront of the cotton manufacturing countries; and she still leads in the export of fine cotton fabrics. Lancashire, with Manchester as its business centre and Liverpool as its port of entry, is the premier cotton manufacturing district of Europe and of the world (see map on p. 119).



EMPIRE COTTON

Top : picking bolls on a plantation in the Transvaal. *Bottom :* weighing bales prior to export from Cape Town. During recent years increasing efforts have been made to develop the possibilities of cotton-growing in British lands.

Other cotton districts in Europe are northern France (around Lille), Germany (around Chemnitz), Poland (around Lodz), Switzerland (where water-power supplies the place of coal), north Italy (around Milan), Spain (around and in Barcelona), and Czecho-Slovakia.

In the U.S.A., New England still leads, but in the south, around Atlanta, the cotton industry is growing. Most of the factories in the U.S.A. began along the Fall Line, using water-power before steam came into general use.

Cotton By-Products. All parts of the cotton plant are used. The seeds, at one time regarded as waste, are rich in an oil, not unlike olive-oil. The seeds are crushed and the oil extracted. The poorer qualities are used for soap and candles, the better for salad oils, or margarine.

Again, the seeds are pressed and made into cotton-cake, a most nutritive food for dairy cows and for fattening bullocks. The seed also is used directly as a fertilizer, for it is rich in phosphates and potash.

The stems and hulls of the seeds are largely used in the U.S.A. as fodder for the cattle kept on the cotton lands. Some, too, are used in paper making. The roots are used as fuel and as fertilizers; whilst the fuzz on the cotton seed is made into a kind of felt and into gun-cotton. Nothing is wasted.

Kapok. A tropical plant, called the *silk cotton tree*, has a vegetable down, something like cotton, covering its seeds. The down, or *kapok*, is very buoyant, and is used as a substitute for cork in making life-belts. It is exported from the Dutch East Indies.

Flax. Fibres other than cotton have long been used for making clothing. Flax was woven 6,000 years ago in Egypt, where mummies of dead kings and princes were wrapped in "fine linen"; and flax seed, or "linseed," has been found in the old Swiss lake villages, with the remains of manufactured flax fibres.

The flax plant may be grown for its fibres or for its seed. Grown for fibres, it is a temperate plant. Grown for seed, it is mainly a tropic plant; the tropic-grown fibres are too stiff, heavy and coarse for making linen.

COTTON AND OTHER VEGETABLE FIBRES 119

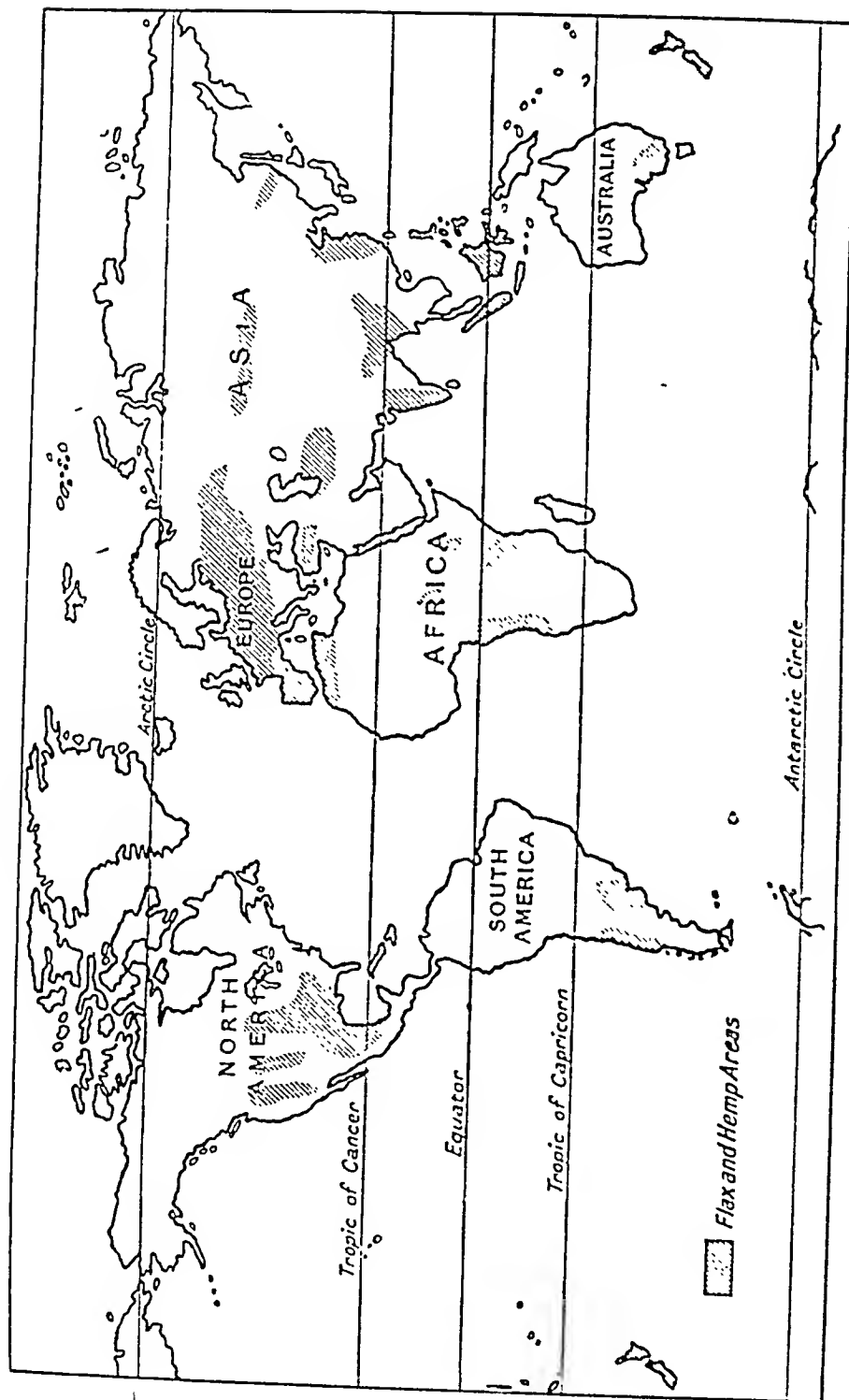


THE COTTON TOWNS OF LANCASHIRE

The plants require good, well-drained, damp, heavy soil, and give finer fibres if planted thickly; they grow to two or three feet high, and have pretty blue flowers. They must be hand-pulled, before the seed has fully developed. The stalks are then "retted," i.e. soaked in stagnant water for a month or so, and passed through heavy rollers, or well beaten, to get rid of the central woody core around which the useful fibres are arranged. These fibres measure from 8 inches to 50 inches in length.

The work required makes the preparation of flax fibre costly. Thus flax, once the most important fibre in the world's commerce, has fallen to third place; the gin has made cotton lint very much cheaper.

The chief flax-growing region of the world is the northern plain of Europe, stretching from Normandy, in France, along the North Sea and Baltic shores, and across Russia to the Ural Mountains. Belgium produces the finest flax; and northern Ireland and the towns of Fife and Forfarshire, in Scotland, manufacture it into linen. Belfast is noted the world over for linen.



CULTIVATION OF FLAX AND HEMP

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Northern France, Westphalia and Japan also manufacture linen. Cambrai, in northern France, still makes *cambrics*.

Lawn is very fine linen.

The heavy cost of the labour needed has caused the cultivation of flax to die out in England and Scotland. Yet the average value of the import of linseed, flax-fibre and oil-cake is over £6 million.

In warmer countries, or where grown for seed, flax is harvested just like the cereals, and thrashed by steam. The great prairie and pampas wheat lands, particularly in Argentina, are now growing much flax for seed.

The seed, when crushed, yields linseed oil, much valued for paint and varnishes. The residue is a fine "cake" for feeding stock. Tons of it are shipped from Dakota, in the U.S.A., to feed the dairy cows of Holland, Denmark and England.

Curiously enough, the growing of flax in winter on the land from which the cotton crop of Egypt has been harvested in summer, is being encouraged. Thus, after an incredible number of years, an old industry is being revived as a "new" one.

Hemp. A fibre similar to flax, but stronger and coarser, is yielded by hemp. It is used chiefly for making ropes and cordage, and canvas for sails. The finer fibres can be employed in making a cloth something like linen—used for coarse towellings.

Hemp has a similar range of climate to flax, and is grown in the same countries. In India it is grown mainly for the intoxicating stimulants got from it. Poland, south Russia and Italy are the chief European producers. Some is grown in the Korea.

Manila Hemp. The best rope materials are made of Manila hemp, which is exported from Manila, in the Philippines. This really is not hemp but a coarse fibre, 8 or 10 feet long, found in the *abaca*, a fruitless kind of banana tree; it grows well only in the Philippines. Ropes of Manila hemp, when worn out, can be ground up for making Manila paper.

New Zealand Flax. New Zealand produces a fibre known as New Zealand flax, though it more closely resembles hemp than flax. It is derived from the leaves of a plant which can

be cut three times a year. The plant grows abundantly in boggy, poor soil, which is useless for other purposes. It has been grown in parts of south-western Scotland.

Sisal Hemp. From the leaves of the *henequen* plant, a member of the agave family, which grows wild over much of the dry limestone plain of Yucatan, in Central America, is obtained sisal hemp. The rocky, unploughable soil is hardly cultivatable at all for ordinary purposes, but the henequen, if it be planted there, will provide 10 or 15 leaves every six months for ten or twenty years. Sisal hemp became commercially important when the use of binding machines upon prairie wheatlands made cheap twine imperative.

Cuba and Jamaica are now cultivating sisal.

Nettles. In the days before cotton was cheap, the common nettle was much used both in England and in Germany as a substitute for flax and hemp. Flax is really a member of the nettle family.

Esparto Grass. In Spain ropes and cordage are commonly made of esparto grass fibres. Esparto or *alfa* is also exported from North Africa and Spain for paper-making. The grass has long roots, is tough, and can resist drought.

Ramie Grass. Fibres, pre-eminent for strength, fineness and lustre, are obtained from ramie, or China grass. They are much used in China for making summer clothing. The ramie fibre is stronger than Russian hemp, and is not easily damaged by wet. It can be used for making anything from ships' cables to table-linen, and even lace and cambrie. The fibres are encased in a gummy substance not removable by retting. It is difficult, therefore, to work, but Japan has some successful ramie mills.

Jute. The cheapest fibre in general use is jute. There are two or three varieties of jute grown in India, Ceylon, China, and in Syria and Egypt, but the cultivation of the plant on a large scale, for the sake of its strong, coarse fibre, is confined almost entirely to the lowlands of the Ganges delta. It will grow on any sort of soil, but needs a tropical climate and flooded land, and much cheap labour to get the fibres from the stems.

From jute fibres *gunny-cloth* and *gunny-sacks* are made.

The sacks are very largely used for wheat and for coffee; the cloth is used for the coverings of cotton and wool bales.

For a long time the manufacture of jute was confined to hand-loom weavers in Bengal. Now there are great factories in Dundee and in Bengal itself. The jute mills in India employ nearly 300,000 workers.

Jute is much used now in making cheap carpets, curtains, and furniture coverings.

EXERCISES

1. Why is the negro almost a necessity around the Gulf shores of the U.S.A.?
2. Why is it particularly desirable that cotton should be grown within the British Empire?
3. Draw a map to show the cotton lands of the world.
4. How came the cotton manufacture to be located in Lancashire?
5. What is artificial silk? Why is it a menace to cotton manufacturers?

XVII. FOREST PRODUCTS

If there be a reasonable rainfall, trees of some kind will grow anywhere between the Equator and the outer edges of the polar regions. Stray trees struggle up even in the poorest soil; and woods and forests thrive wherever wind and weather are favourable.

The three main classes of woodlands are :—

1. The sub-arctic, or cold temperate, forests of coniferous trees¹—pine, fir, spruce, larch, and so forth.
2. The temperate forests of deciduous trees—oak, maple, beech, chestnut, ash, and elm; and
3. The tropical forests of hardwood trees and palms.

Coniferous trees are mostly soft woods.

Deciduous trees are hard woods.

The products which the forests yield to man may be grouped as follows :—

1. Wood or timber, and bark;
2. Fruits and nuts;

¹ Coniferous forests are also found in lower latitudes at high altitudes—i.e. on mountain-sides and tops.

3. Saps and juices, from which a bewildering variety of substances—from turpentine and pitch to rubber and tannin—are obtained; and
4. The raw material for paper-making.

Timber. Wood is a bulky commodity. To transport it on land is difficult and costly. Generally speaking, therefore, it is exported only from countries and districts with easy access to river, lake, or sea. Canada, being well served in this respect, has a large trade in timber. Russia, Finland, Sweden and Norway are the chief European exporters.

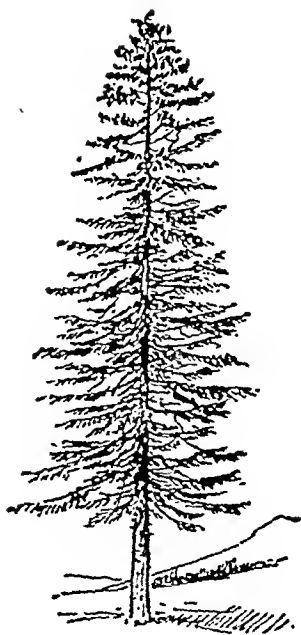
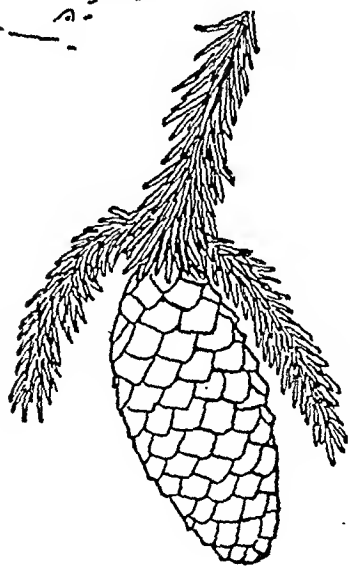
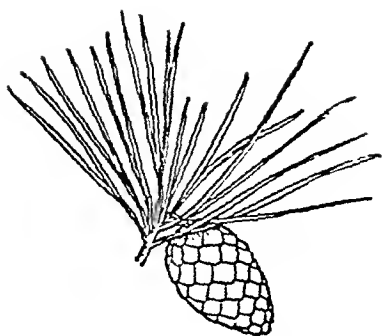
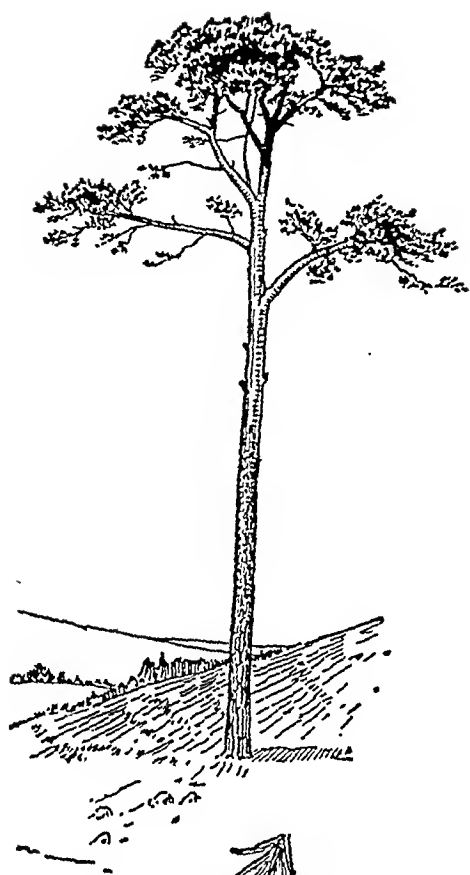
In Siberia lie vast areas of untouched coniferous forest; these forests cannot be used till means have been found of overcoming the navigation difficulties of the frozen north-running rivers—the Obi, Yenisei and Lena. The cone forests of the southern hemisphere also are difficult of access; whilst those of the U.S.A. have very largely disappeared as a result of extravagant cutting to satisfy the home demand.

Soft woods are mainly used in building construction and in paper-making. Firs and pines provide pit-props. Great Britain imports pit-props, for use in her mines, to the annual value of £7 million.

The luxury woods used in making good furniture are largely temperate hard woods like oak and walnut. Australia has some excellent hard woods which are now used for street paving. The *jarrah* and *karri* of Western Australia are especially valuable for this purpose; they are also used as piles both in tropic and temperate waters.

Tropical woods vary greatly in quality. While some are very valuable, some are spongy, coarse and stringy, and others are gnarled and twisted. The valuable varieties do not grow in stands, or clumps, as do the Douglas firs of North America; they are usually scattered among brush, and useless trees. Rarely, for example, are more than two mahogany trees found in an acre of ground. This adds greatly to the cost of cutting and transport.

Other valuable woods are too heavy to float in water, and so cannot be carried down to navigable waters by spring freshets, as is much of the lumber of the colder coniferous north. Burma ironwood sinks in water.



CONIFEROUS TREES

Top : pine tree and cone. Bottom : fir tree and cone. Note how the trees differ in shape ; also that the needle-like leaves of the pine are arranged singly, whilst the leaves of the fir grow in tufts of two, three, or five.

Burma teak is invaluable for ship-building, as it is not only hard and durable, but is of an oily nature. This prevents it deteriorating in tropic waters in the manner of oak, and also prevents it rusting iron.

Teak grows over much of south-eastern Asia, but it is exported mainly from Burma, where it is floated down the Irawadi to Rangoon. The trees have to be "ringed," and so killed, before they can be floated down the rivers; when full of sap they are heavier than water.

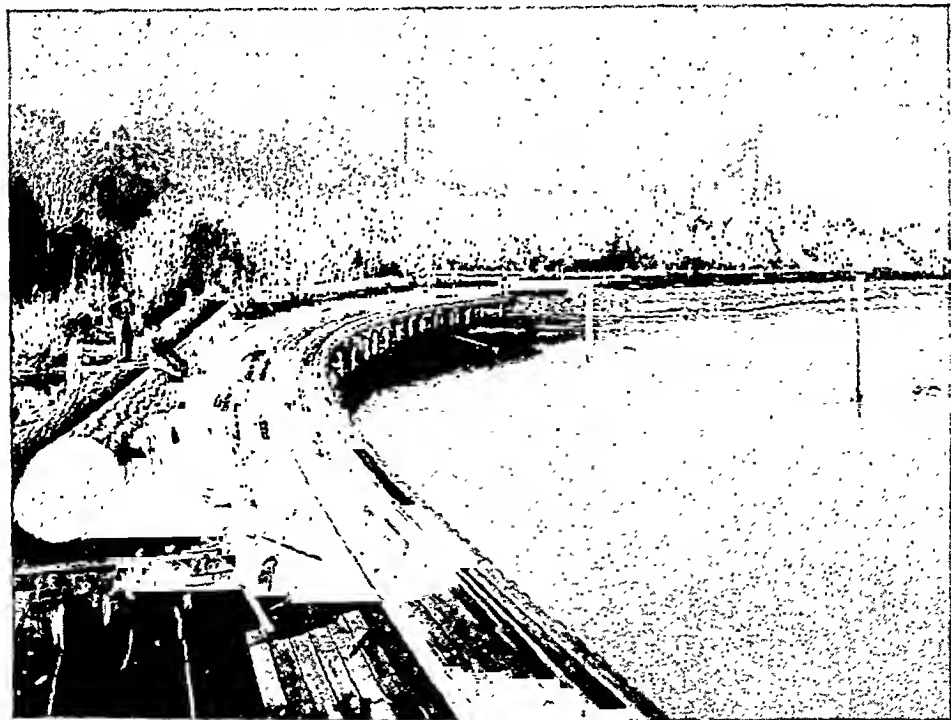
Some 60,000 tons of teak, worth £ $\frac{3}{4}$ million, are exported annually from Siam. Burma exports 360,000 tons.

Mahogany, a favourite cabinet wood, is obtained mainly from Central America. Some is obtained from West Africa. It is not really as hard as oak, and it is light enough to be floated down rivers. Other tropic woods are ebony, rosewood, and various kinds of cedar.

Owing to the difficulty of using tropic woods, much softwood from the north is imported even into the heart of Amazonia. Manaos, a town in Brazil, is surrounded by the forested selvas. Yet its buildings are made of imported pine, because the extreme hardness of the local woods would turn nails and blunt tools.

The *quebracho* tree of the Gran Chaco part of the Parana-Paraguay basin is a subtropical wood of such hardness that its name means "axe-breaker." Being very rich in "tannin," it is much used in leather-making. Moreover, by reason of its hardness, and the resistant qualities given to it by tannin, it makes excellent railway sleepers; ants and other insects find it very difficult to devour such wood.

Cork. Cork is the tough outer bark of a kind of oak tree, which grows on the highlands of the western Mediterranean area. The trees can be stripped of bark every three or four years without being damaged. Cork forests cover more than $\frac{3}{4}$ million acres in Spain, and nearly as much land in Portugal. Algeria has over a million acres of cork forest, but does not export as much as Spain. Some 45,000 tons are exported annually from Spain, and a similar amount from Portugal. Though bulky, cork is light, and so can be carried on mule-back from difficult hilly regions.



[Photos : C.P. Railway.]

TRANSPORTING TIMBER

Top : floating timber down a Canadian river. *Bottom* : a timber train on the Canadian Pacific Railway. Timber is mostly exported from regions with easy access to rivers or the sea ; to transport it by road or rail is costly and difficult.

Peruvian Bark. The bark of the *cinchona* tree yields quinine and other tropic medicines. The first European supplies were obtained from the eastern slope of the Andes, where cinchona trees grow wild. This area was in the old Spanish vice-royalty of Peru. So the bark came to be known as Peruvian bark.

Nowadays supplies are mostly got from plantations in Ceylon, India, Java and Sumatra. Cinchona is also grown in Jamaica.

Nuts and Fruits. The coco-nuts, chestnuts, walnuts, almonds and hazels of commerce are foods, or luxury foods, which were obtained originally from forest trees, but now are derived mostly from cultivated trees. The Brazil nut from Amazonia, however, is still mainly a wild product. Coco-nut plantations are spreading in all the equatorial regions; the copra and oil which they yield are valuable products. Bananas and breadfruit are staple articles of food in the regions where they grow.

Palm-Oil. The oil-palm, a native of West Africa, yields palm-oil. The habitat of the tree, which grows to a height of 30 feet, is anywhere between 10° N. and 10° S. latitude.

The fibrous matter surrounding the kernels of the fruits is boiled off, and from this is obtained the oil which is used for making margarine and high explosives. The kernels are exported whole and the oil pressed out by machinery. Free-town and Lagos are the chief ports for palm-oil.

Ivory Nuts. The product of a palm growing in Colombia, Ecuador and the Sudan is exported for button making. The nuts, which are known as ivory nuts, are as large as hen's eggs at times. The tree produces 30 pounds of nuts a year, and lives for fifty years.

Gums and Resins. Some trees have saps which solidify in air. From these are obtained gums and resins. Gums are soluble in water, but not in alcohol or turpentine. Resins, on the other hand, are soluble in alcohol and turpentine, but not in water.

Resin, or *rosin*, is derived from the sap of cone-bearing trees after the oil of turpentine has been separated. British supplies come mostly from the U.S.A.; European countries, with pine



[Photo: Dr. M. de Hartogh.]

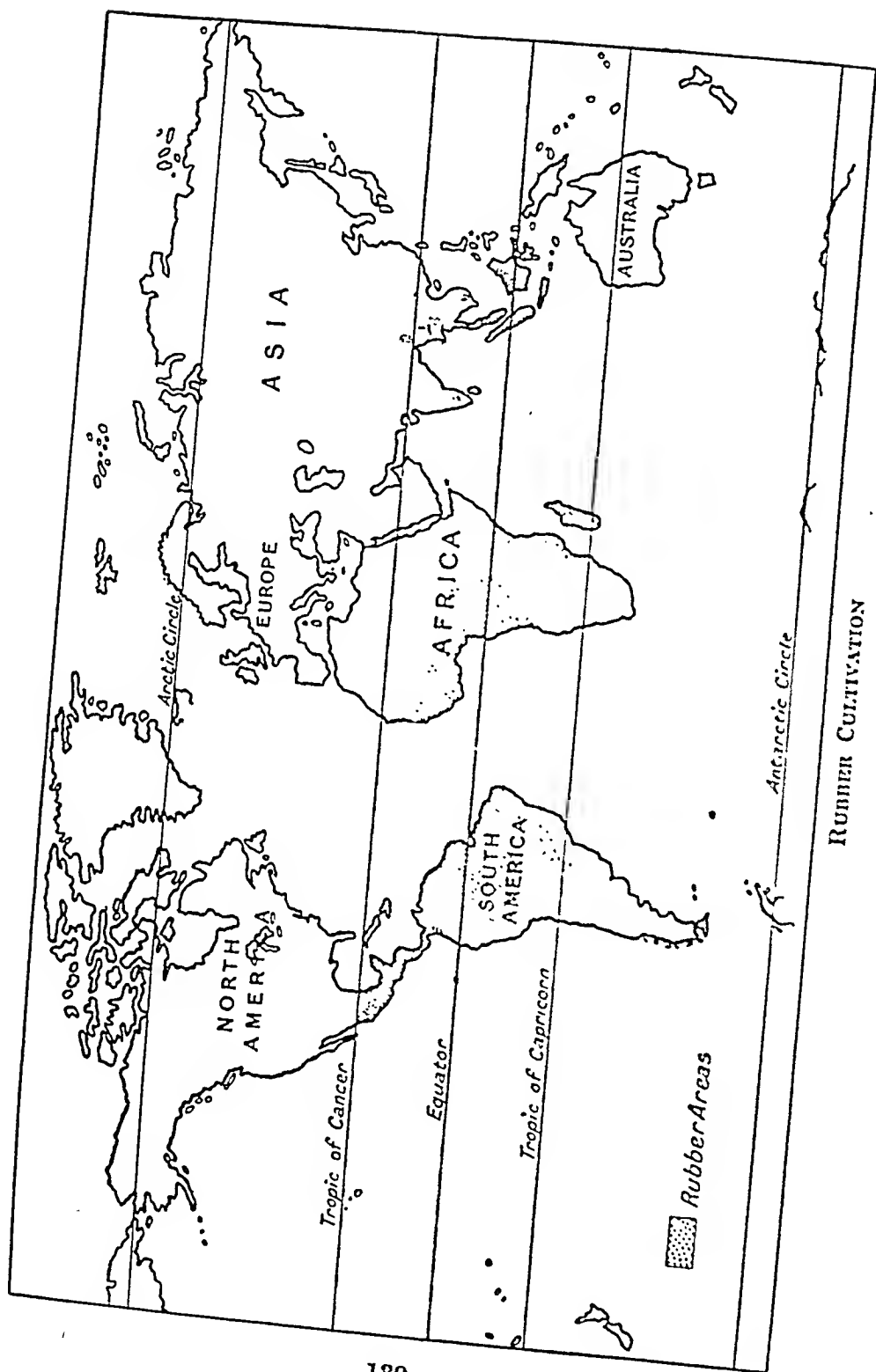
HARVESTING CINCHONA-BARK

on a plantation in Java. The bark of the cinchona tree yields quinine and other medicines.

and fir forests, send instead wood-tar, or *pitch*. This is got by burning the wood in covered pits, without a flame being produced. From wood-tar is obtained creosote, a substance used for preserving timber. Rosin is used in making paper and soap.

Amber is also a resin, a resin which was formed by long-dead pines. It is found washed up on the Baltic shores of Germany. It was esteemed greatly by the ancient Greeks, and is still used for making ornaments.

Dyes and Dye-woods. Before modern chemists discovered how to obtain colourings from coal-tar, the tropic forests



RUBBER CULTIVATION

provided the most important dyes. *Logwood*, exported from Yucatan, the West Indies and British Honduras, is a dark-red colour; from it could be got an extract used in dyeing materials blue, brown, and black. *Indigo* is a fine blue dye obtained from a shrub, native to the tropical parts of south-eastern Asia; up to the end of the 19th century it was an important export from India.

Rubber. There are a number of tropic trees and climbers which yield a juice or sap that coagulates into rubber. Some temperate plants also contain the juice.

The invention by Charles Mackintosh (1766–1843) of waterproof clothing greatly stimulated the demand for rubber, which is now one of the most important articles of commerce. Strengthened by fibrous material, rubber is used for making motor tyres.

The best rubber was originally got from a class of trees growing wild in the Amazon basin, and was exported through Para at the Amazon mouth in Brazil. The collection of wild rubber was a difficult and unhealthy job, mostly undertaken by Indians or half-breeds. Slits were made in the trees, and the outflowing sap was collected in cups at the bottom as a *latex*, or milk. This had to be coagulated within 24 hours, or putrefaction set in. To coagulate it a paddle-shaped wooden utensil was dipped in the liquid and then held in the smoke from a fire. Frequent dippings gave a ball about the size of a man's head.

After experiments had been made in the Botanical Gardens, Kew, the Para rubber tree was introduced into India and Ceylon. Subsequently seeds were successfully grown in the Malay Peninsula and the East Indies, where the climatic conditions are similar to those of Amazonia.

Tropical weather—heat and rain together—are needed for rubber growing. A temperature of well over 75°, and from 80 to 120 inches of rain, are wanted for good supplies. Plantation rubber can be grown nearly everywhere below 2,000 feet in the equatorial belt.

Wasteful methods of collecting the juice—frequently the whole tree was cut down, or was bled to death—have led to a diminution of the wild product. At the beginning of the

20th century 50,000 tons of wild rubber were collected yearly, and only 4 tons of plantation rubber. Now something like 500,000 tons of rubber come from the plantations of Malaya, the Dutch East Indies, Ceylon and India, while the wild production has decreased to about 25,000 tons. British Malaya exports, through Singapore and Penang, 250,000 tons.

Plantations are now springing up in the Congo Basin and in Amazonia.

Paper-making. The art of paper-making was introduced into Europe from China in the 15th century. For two or three hundred years paper was made from cotton, woollen, and linen rags. Then a process was invented of making it from the tough fibres of the esparto grass which grows in the arid parts of northern Africa and Spain.

Paper is essentially the cellulose material of various vegetable fibres ground to a very fine pulp in water and then spread out thin to dry. But paper so made would not be writing paper; it would be a porous variety, more like blotting, or filter, paper. To be rendered suitable for receiving ink, the pulp must be bleached and treated with "size," a compound of rosin and alum.

Cheap papers are now made of wood-pulp—chiefly from pulped spruce, hemlock, and some species of fir and pine. For pulping the wood much pure water is wanted, also engine-power to drive the machinery. Large paper-mills, therefore, have been established in the heart of the softwood forests—near waterfalls where possible—of Sweden, Norway, Finland, Central Europe, the U.S.A. and Canada.

The cheapest wood-pulp is simply mechanically-ground wood and is used for cheap newspapers. Good papers have the wood chemically changed, or "digested," so as to give a longer and stronger fibre.

Machines will turn out rolls of paper 5 miles long, and 3 or 4 feet wide, at the rate of 500 feet per minute, and 25 tons per day.

The U.S.A. is the largest consumer of paper. Great Britain and Germany come next. Sweden exports pulp and paper worth about £18 million annually; Norway £12 million; and Finland £6 million. Germany also exports large quantities.



[Photo : Rubber Growers' Assn., Inc.]

TAPPING RUBBER

on a plantation in Malaya. Notice the slits, clearly visible in the tree in the foreground, for the *latex*, or milk, to run down.

Great Britain, though a big importer of cheap paper, exports papers of good quality.

EXERCISES

1. What sort of climate is necessary for (i) pine trees ; (ii) oak trees ; (iii) mahogany trees ?
2. Where do the trees grow from which "cork" is obtained ? What sort of climate is necessary ?
3. What "raw" products can be got from the Amazon forests ?
4. Why are waterfalls and rapids in forest regions useful ? How can they be a disadvantage ?
5. Give some description of the raw material, other than timber, provided by tropical trees.

XVIII. MINERALS

There is a vast difference between a primitive digging-stick and a modern "cultivator." But the man who first thought of scratching the earth with a pointed stick, the man who first hardened that stick in a fire, and the man who tied a sharp-edged stone to it with sinewy threads to make it dig deeper and better, were in their own time and place great inventors, as great as any of the men who have devised the wonderful machines used to-day.

Man progressed by the tools he made, and saved himself alive by the weapons he invented. Probably the first weapon he grasped was a bough, broken by wind from a dying tree, and his first agricultural implement was probably a pointed stick. His first improvised machine for manufacturing was the thumbstone or *colith*. With this he scraped the meat from off the bones he gnawed ; with this he cleaned the scraps of uneaten flesh off the hides he meant to wear in wet and windy weather ; and with this he made his first efforts to utilize the world's mineral wealth.

Copper. Lying loose in various parts of the world are stones and rocky lumps containing a large percentage of almost free copper. Copper at ordinary temperatures can be beaten into shape, and a lump that by chance got near the fire would show some inquiring mind how first to warm and then beat it into shape. From working in copper, men were led on to work

in tin and bronze, and, later, to smelt iron ores and make steel.

Nowadays copper is important because it is a good conductor of electricity. It is used in the making of underground telegraph wires and marine cables. Brewers' and distillers' plant, parts of big guns, bottoms for ships and plates for printing textiles are also made from copper.

The yearly production varies from $\frac{1}{2}$ million to $1\frac{1}{2}$ million tons. Of this the U.S.A. produces more than half. Chile comes second as a producer.

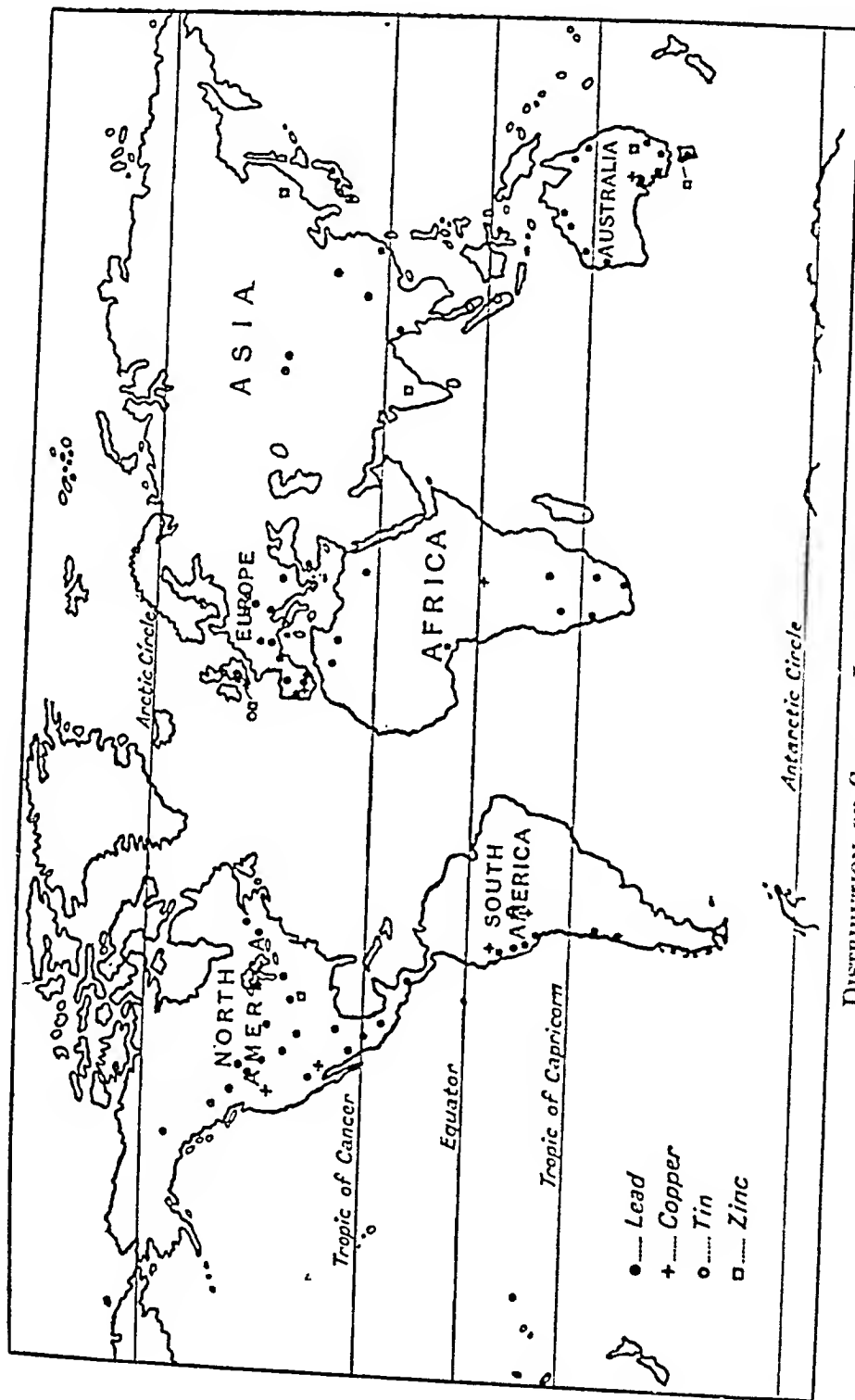
Copper is found in the Rockies and the Andes, almost from one end to the other. There are rich mines at Butte, in Montana State, and mines richer still in Arizona. Mexico, Peru and Bolivia, also, have big deposits. The Old World copper mines of Spain, known to the Phoenicians, are still producing. In England copper mining has declined of later years, though much smelting and refining of Canadian and Spanish ores is done at Swansea. Katanga, in the Belgian Congo, has copper ores extending over an area 750 miles long and 40 wide.

The two important alloys, *bronze* and *brass*, are chemical combinations respectively of copper and tin, and of copper and zinc.

Tin. Once valuable for making the alloy known as bronze, tin is now prized on account of its non-rusting and air-excluding qualities. Tin cans and pails are sheet-iron washed over with tin.

Air can get through the pores of thin steel. Tin, on the other hand, is air-tight.

The civilized world of 2,000 years ago sought tin in the "barbarian" isles of the west—Cornwall and, probably, the Hebrides. Cornwall still produces tin, but the civilized world now seeks the metal mostly in the Far East. Malaya, Banks and Billiton, near Sumatra, in the Dutch East Indies, China and Australia, all export tin. Stream-tin found in river sands in the Malay Peninsula is largely worked by Chinese labourers. Nigeria also now exports tin; and Bolivia, in South America, has very rich mines near Potosi. These mines are up on the plateau from 14,000 to 18,000 feet high. Until recently the tin was carried down on llama-back.



DISTRIBUTION OF COPPER, LEAD, TIN AND ZINC

Zinc. China and India used zinc in making brass long before the metal was known in Europe. Methods of treating zinc-ores were not discovered in Europe until the 18th century. The U.S.A. has rich supplies of zinc around the Ozark Mountains, and Australia exports the metal from the Broken Hill mining area, in New South Wales, and from Tasmania.

Lead. The use of gas- and water-pipes in the 19th century added greatly to the importance of lead. White lead is used in making painters' colours and in glazing earthenware. Red lead is used in making porcelain and flint glass.

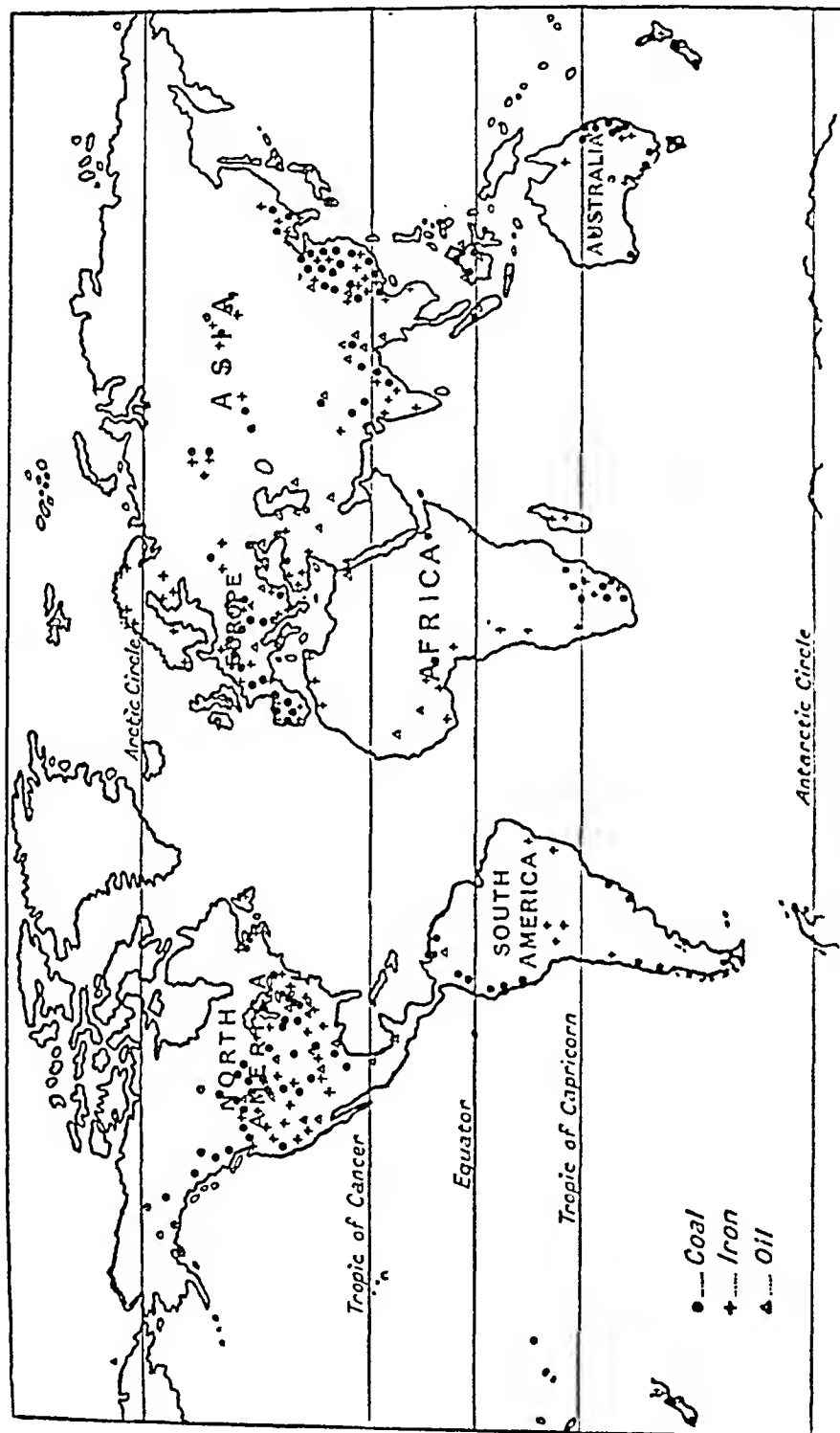
Lead is found in an ore called *galena*. Silver and zinc are often found mixed with galena. The U.S.A., Mexico, Australia, Spain and Canada are the chief countries producing lead.

The Iron Age. Though the Bronze Age passed into the Iron Age before the Christian era began, the *real* Iron Age began towards the end of the 18th century, when machinery came into general use. Perhaps the age which started them should be described as the Iron and Steel Age, for it was in its changed form of steel, that iron, the commonest and cheapest of the metals, then became of supreme importance.

Iron ore was smelted in Britain, by means of charcoal, back in Roman times. Charcoal is made from wood. Hence, as the forests of the Weald and Central England became used up, British iron production gradually declined, until in the 18th century a method of using coal and coke for smelting was discovered. Then Great Britain, with her rich supplies of iron ore, coal and limestone in close proximity, and her inventive machinists, forged ahead in the iron and steel industries. Her production rose from under 20,000 tons a year in the middle of the 18th century to over 120,000 tons at the end. Now her production of pig-iron is something over 6 million tons a year, and of steel about the same; the amount varies with the rise or fall of trade and commerce.

Much of the iron ore now used in Britain is imported from northern Spain and Algeria; whilst fine quality ores, for making cutlery, are obtained from northern Sweden, through the ice-free port of Narvik, in Norway.

The U.S.A. not only has larger supplies, but surpasses all other countries in the production of iron and steel. The richest beds



DISTRIBUTION OF COAL, IRON AND OIL

are at the western end of Lake Superior. There, once the surface layer has been taken off, the ore can be scooped up in steam-shovels, tons at a time, and loaded into ore-ships, of as much as 12,000 tons burden, to be rushed to the shores of Lake Erie and smelted at Cleveland, and other towns, with coal from Pennsylvania; or taken in monster trains from the lake to Pittsburg, the greatest iron and steel centre in the world.

The U.S.A. produces as much as 45 million tons of pig-iron a year, and a like amount of steel. The country also imports ore from Chile, Cuba, Sweden, Spain and Algeria.

Modern transport improvements have lessened the need for coal and iron to be found together. Nowadays the tendency is for machinery to be made where it is wanted.

The Lorraine iron ores, of low-grade, phosphoric composition, have been made of value by modern smelting methods. The production of iron and steel in the combined Franco-Belgian manufacturing area is now larger than that of Great Britain. Germany supplies her Westphalian manufacturing area from the same Lorraine ore-fields, using coal from the Ruhr and Saar coalfields near. The Silesian iron area is now partly in Germany and partly in Poland. Germany's production of iron and steel is twice as large as Great Britain's. Russia has ironfields in the centre and south around Tula, and in the Donetz basin.

Iron is now being smelted by electric methods. The iron and steel industry is likely, therefore, to be developed greatly in countries which have water-power and much ore—in Sweden, for instance, where the almost solid masses of nearly pure magnetic ore in the Gellivare district are very near to waterfalls.

Several different varieties of steel are now produced by adding toughening metals, such as manganese, nickel and tungsten. Stainless steel is made by adding chromium.

Coal. Long-buried forests—forests that flourished ages before man was born into the world—furnished in the 19th century most of the power that drove the wheels on which the business and manufacturing world revolved. In the 20th century the place of coal is being taken by oil, and by electrical power dependent upon waterfalls. Coal, however, is still of great importance.

The woody fibres of the forests of the Carboniferous Age

were slowly changed in their chemical composition. The heat and pressure they had to undergo when buried, drove out most of the oxygen and hydrogen they contained, leaving behind a seemingly hard stone containing carbon; almost pure carbon in the case of anthracite; over 80 per cent. of carbon in bituminous coal; and from 50 per cent. and upwards in the lignite or woody coal, a product of a later age than the carboniferous.

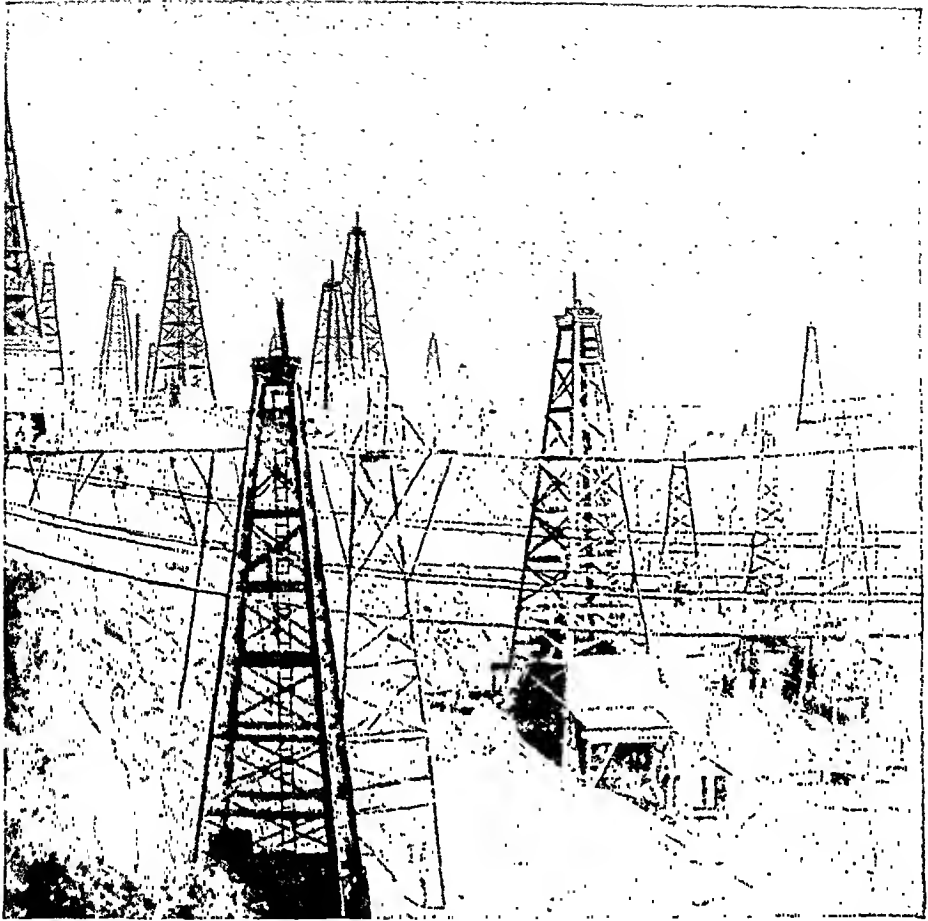
The world production of coal is now from 1,200 million to 1,500 million tons a year. The chief producers are the U.S.A., Great Britain and Germany, though much of the German coal is lignite or woody coal. The U.S.A. mines over 500 million tons a year; Great Britain half that amount; and Germany a quarter in real coal, and another quarter in lignite. Great Britain sends abroad over 50 million tons a year, in addition to the bunker coal taken in by vessels at British ports. China, Japan, India, France, Belgium and Czecho-Slovakia mine some 20 millions each.

Petroleum. Of late years immense quantities of oil have been tapped in the earth's crust. Oil will flow, and so need not be laboriously transported; it can be pumped up from wells and driven along pipes to the place where it is wanted or to the waiting oil-tankers in harbours by the sea.

Crude oil from the wells can be split up into a variety of marketable products—petrol, kerosene, diésel oils, lubricating oils, fuel oils for developing steam, bitumen, vaseline, paraffin wax for candle-making, and medicinal paraffin oil. The petroleum, or rock-oil, as it is pumped up, or as it gushes out, may be one of two main sorts: it may have a paraffin base, or it may have a petrol base.

America leads the way in oil production, with the U.S.A. first and Mexico second. The Russian and Persian oil wells are third and fourth. About 1,000 million barrels of 42 gallons each are produced every year. Burma also exports oil.

Aluminium. Though a constituent of common clay, aluminium, a metal which is now very much used in the making of motor-cars and aircraft, cannot as yet be extracted direct from ordinary clay. It is rather costly, therefore, to produce. It is light, tough, non-corrosive and a good conductor of electricity.



[Photo : M. Crouliansky.]

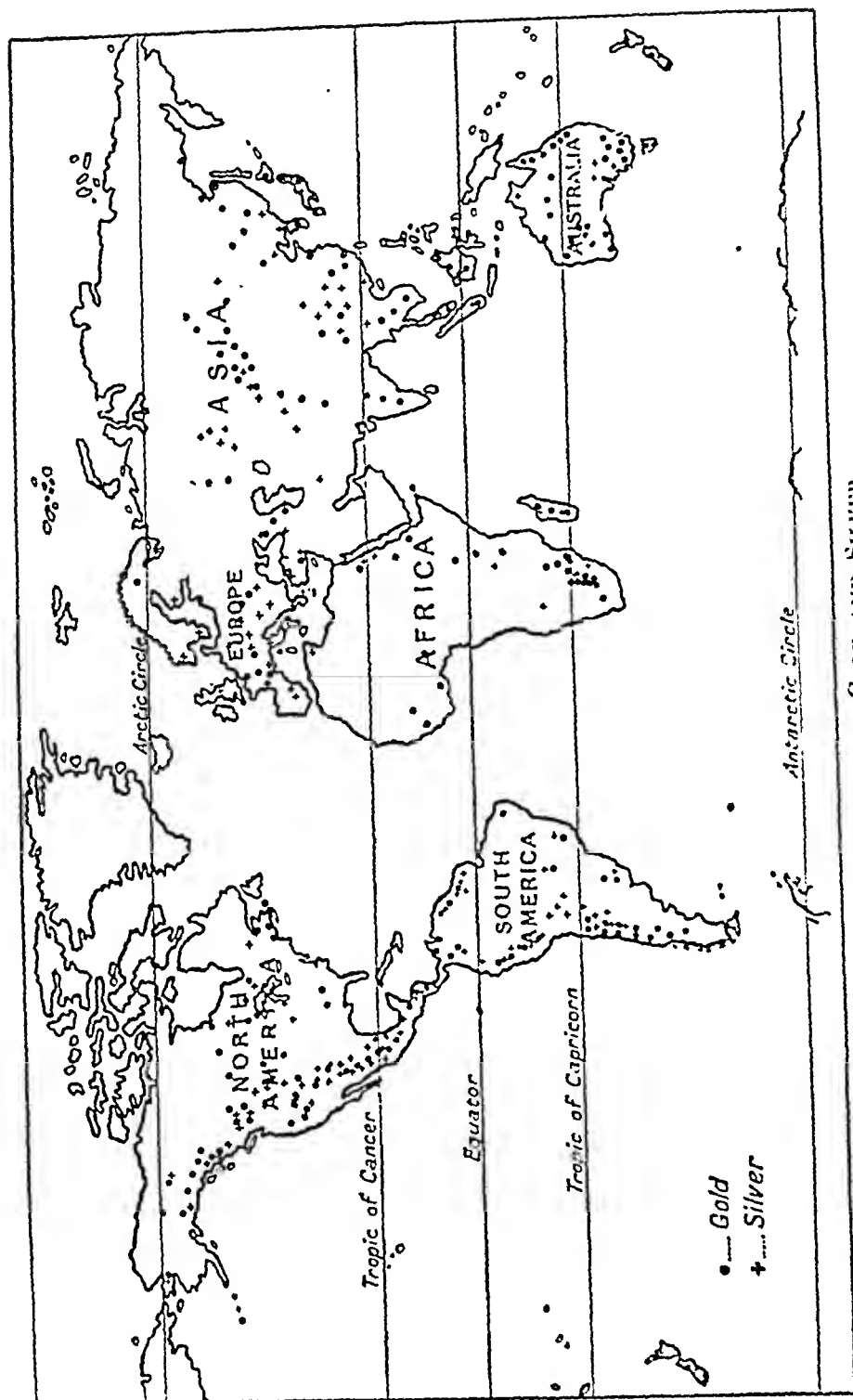
AN OIL-FIELD IN BURMA

Though its production is small compared with that of the U.S.A., Mexico, Persia and Russia, Burma is very rich in mineral oil.

The ore from which it is most generally extracted is called *bauxite*. In 1880 only 2 or 3 tons a year were extracted, and the metal cost nearly £2 per pound. Modern processes have greatly increased the production, and have reduced the cost to a shilling a pound.

The total world production is now about $\frac{1}{4}$ million tons a year. Most of it is made in the U.S.A., but there are important works in Scotland, Switzerland, Norway and France.

Precious Metals. Gold and silver have long been desired by men and women as ornaments because of their sheen and glitter, their beauty, and their value. Being fairly soft, they



DISTRIBUTION OF GOLD AND SILVER

are malleable, so ornaments can easily be shaped of them. Moreover, they are durable and do not rust.

These two precious metals long ago became the "moneys" of the trading world, and so most things were estimated as to their worth by the amount of gold or silver a trader would give for them. Nowadays, since silver is common and gold comparatively scarce, gold only is the real money of the Western World.

Gold is mined principally in South Africa. The mines of the Witwatersrand, near Johannesburg, in the Transvaal, are the richest in the world. The metal also is found in Rhodesia, in West Africa, part of which is known as the Gold Coast, and in Australia, New Zealand, Canada, the U.S.A., and Mexico.

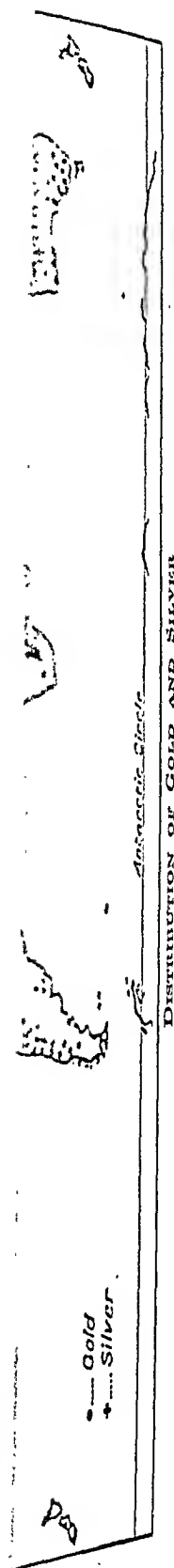
Gold and silver are found in the Rocky Mountains and Andes from one end to the other. Mexico and the U.S.A. have the richest mines. The Canadian goldfields are mainly in British Columbia and in the old Laurentian Plateau part of Ontario.

The silver found in the workings of the Andean ranges is now a secondary product. It is joined, chemically, with the galena ores of lead and with tin and zinc. The mines, therefore, are worked for those metals, the silver being separated as a by-product. Yet the Spaniards explored and conquered these regions for their silver and gold in the past.

Diamonds. India supplied the few diamonds which reached Europe in the Middle Ages. Early in the 18th century diamonds were found in Brazil. Now the mines of Kimberley, in South Africa, are the principal source of supply, though diamonds are also obtained from British Guiana, the Belgian Congo, and South-west Africa.

The stones are found mostly embedded in a kind of blue clay which seems to have been formed at some time or other in the vents of old volcanoes. Their hardness, sparkle and rarity make them precious.

Most of the diamonds which are found are sent to Amsterdam or Antwerp to be cut. There, it is said, some 10,000 diamond cutters are employed. The stones are very dear to buy. Thus, when trade and business slump, there is a slump in the diamond industry, and both diamond cutters and miners suffer.



Good trade in the U.S.A. at once brings prosperity to Holland and South Africa.

Salt. A cheap but very necessary mineral is salt. English kings of the Middle Ages prized their possessions near Bordeaux because that part of France produced wines and salt; and salt then was both scarce and dear in England. To-day salt is obtained (a) from mines of solid rock-salt; (b) from the salt brine pumped up from the earth's interior; and (c) from evaporated sea-water.

The salt mines of Cheshire have made England independent of imports. Much salt is used in making chemicals.

Mineral Fertilizers. The crops of the modern world are much larger than those of ancient days because farming is more scientific. Chemists have shown what constituent each variety of plant takes from the soil, and what it leaves in. Soils, therefore, are treated with fertilizers to encourage growth.

Many plants need nitrogen. This is put on the soil in the form of nitrate of soda.

Along the rainless coast of Chile are huge deposits of nitrate of soda. They are supposed to have been made by entrapped seaweed decaying and dissolving in salt sea-water. These nitrates are soluble in rain-water, but, as there is no rain in that part of Chile, they remain in the narrow plain between the coastal range and the Andes.

Potash salts are mined in Germany and Alsace. They are imported by the U.S.A., Great Britain and Italy.

Phosphates aid grass and clovers. Hence sheep fatten more quickly after the soil has been manured with basic slag, which is obtained by smelting phosphoric iron ore. Florida, Tunis and Algeria export natural phosphates.

EXERCISES

1. Why should a man with an iron spear fear a wolf less than one with a stone axe?
2. Why did the invention of weaving machines lead to an increased demand for coal?
3. What effect has the discovery of petroleum in the U.S.A. had upon coal-mining in South Wales?
4. Why are Lascars employed upon steamships more than upon sailing ships?
5. Why should the state of California prefer its irrigated farms to its one-time gold-mines?

XIX. LAND AND RIVER TRANSPORT

One of the main problems connected with trade and commerce is the removal of goods and commodities from the places where they are made, or produced, to the places where they may be wanted.

The earliest carrier was man himself; and in certain wild, wet, pathless forest lands, like those of equatorial Africa and of South America, men still act as beasts of burden. In parts of Africa, too, in the tropic lowlands which are infested with the tsetse fly, an insect deadly to cattle and horses, human porters likewise have to be employed; and where animals are few and men are many, as in parts of China and Japan, men are still the diggers and carriers, the pushers of barrows and pullers of *jinrickshaws*.

Beasts of Burden. A man can carry for 20 miles a day a load of about 40 pounds, rather less than half a hundredweight. A horse can carry on its back, or in panniers on its sides, some 3 or 4 hundredweight; also it can travel farther in a day than can a man.

A rival of the horse, and easier to keep and feed, is the ass—strong, stubborn, patient and untiring. In mountainous lands, such as Mexico and the Spanish peninsula, the mule is more commonly used than either horse or ass.

Oxen. The ox has drawn the plough, trodden out the corn, and pulled a bullock-wagon for untold generations in the East. In Saxon England the ox was the draught animal, not the horse; and the Boer farmer in South Africa continued to journey in a wagon behind a string of oxen until well into the 20th century.

As a working animal, the ox has a quality which makes it preferable to the horse in poorer lands. When living, it is cheaper to feed, when dead, it can be eaten. In India and Burma oxen are very generally used. Nearly 150 million are to be found in India alone, besides some 30 million slow-moving water-buffaloes.

Travelling by bullock-wagon is a leisurely, time-devouring process. The rate of travel rarely exceeds $1\frac{3}{4}$ miles an hour, and a day's journey amounts on the average to about 15 miles.

Special Draught Animals. The camel of the desert patiently carries his load; while the elephant of the teak forests and timber-yards of India and Burma lifts anything up to 8 cwt. The Eskimo dog and Lapp reindeer rush sledges at a great pace over the Arctic northern lands; and even in Belgium and northern France dogs are much used for pulling small wagons of garden produce. Other less well-known working animals are employed in certain districts.

The hairy yak, a cousin of the ox and buffalo, is well fitted for crossing the lofty Himalayas, between India and Tibet. It has so much hair on its lower limbs that, if it lies down to sleep on its own hairy mattress, there is little danger that the extreme cold of high altitudes will freeze the body above.

In South America the llama is used on the higher Andes. This beast, a native of South America, resembles both the sheep and the camel. It can carry a load of about 100 pounds; and, like its relatives, the vicuna and alpaca, it is very sure-footed.

Rivers and Canals. Animals have a much greater transport value when they can be attached to some form either of sledge or of wheeled vehicle. A horse that could only carry 3 or 4 cwt. on its back can pull a ton or more over a good road when the load is on a sledge or in a cart.

The Romans of old made excellent roads. But during the Middle Ages roads practically ceased to exist in Europe. It was largely because of this that river-ways became very important in England and other lands, and continued to be important till the end of the 18th century.

Man early found that he could hollow out a tree-trunk, or make himself a raft, on which to float his goods to a market. Thus, before the days of roads, real roads, or spring carts, the Yorkshire wool trade was greatly helped by the many tributaries of the River Ouse which converge on York, Selby and Hull.

The great rivers of China have been used as highways for thousands of years. The Nile was used even before the Pyramids were built; boats floated down with the current, and made their way up by means of a sail filled by the steady wind from the north.

In early days tracks for pack-animals made their way, as far as possible, to navigable water. Thus the Thames, the Rhine and the Volga were made to serve the ends of trading. As trade increased the rivers of France and Western Germany were joined by canals; it is possible now to travel by canal from the English Channel through France to the Mediterranean, or from Rotterdam up the Rhine, and by the Ludwig Canal to the Danube, and so on to the Black Sea.

Railways and Motor-Cars. Modern trade needs more than rivers and canalized water-ways. Rivers run where they want to, or according to the laws of gravity—not in the direction which man desires; whilst canals are costly to construct and, at times, difficult to keep supplied with water. So modern traders, with the 19th-century discoveries of steam-locomotion to help them, set themselves to build railways that should go where they would provide the quickest, easiest, and most useful routes.

The 20th-century motor-cars made the modern form of macadamized road much more valuable, even supplanting railways for certain purposes. Motor-cars are even replacing the time-honoured camel caravans in such out-of-the-way places as the Gobi Desert of Mongolia.

EXERCISES

1. Why should regions which have only human transport make little progress?
2. Why has China, with its dense population of farming peoples, comparatively few draught animals?
3. In what respects are river-ways helpful to primitive peoples? Why are they not always satisfactory in highly-civilized lands?
4. From your atlas work out the lengths of navigable water in the Yang-tse, the Hoang-Ho and the Amur.
5. Why are the Siberian rivers and the Maekenzie of little use as carriers for ocean traffic?

XX. TRANS-CONTINENTAL RAILWAYS

Mechanical transport has made the world trade of the present day possible—*physically* possible and, owing to the great bulk which each ship can carry, *financially* possible. Railways and steamships, indeed, have revolutionized trade.

Each great world-port is now the centre of a maze of lines running back into and across its hinterland. London, for example, is the centre of a spider's web of radiating and cross-linked lines. New York is a similar centre.

Trans-continental lines (see the map on pp. 152-3) are a more recent development.

North America. The Canadian Pacific Railway opened up Canada, joining west to east and making possible settlement along the fertile farm lands of the Manitoba and Saskatchewan prairies. Two other lines, the Canadian National and Canadian Northern, now supplement the C.P.R.

In the U.S.A. there are four main trans-continental lines, linking the great eastern cities, New York, Philadelphia and Washington, with the western states of Oregon and California, and joining up both to east and to west the middle cities of St. Paul, Chicago, St. Louis, and the southern cotton port of New Orleans. The fruit and oil of California and the timber of Oregon are thus placed easily at the disposal of thickly-populated eastern states. The central lines connect the Asiatic trade of San Francisco, the Golden Gate of the West, with the manufacturing east.

South America. In South America there are bunches of lines running from Rio Janeiro, Buenos Aires and Monte Video to the mining, coffee, farming and ranching districts behind, but only one trans-continental line runs straight from east to west—that from Argentina to Chile through the Uspallata Pass. The great height to which the track has to climb, the heavy winter snowdrifts, and the different gauges of the two countries through which it passes, make this much-needed line of less value than it otherwise would be.

The mines of Peru and Bolivia are joined by railway to the nearest ports on the desolate shores of the Atacama region.

Africa. African railways run inwards from the sea in the French colonies of the north-west, in West Africa and in parts of East Africa. The South Africa railways are numerous; and there is now almost complete rail or steamboat connection between Cape Town and Cairo, though Cecil Rhodes's dream of a through line from Cape Colony to Egypt and the Mediter-

anean has not yet been fully realized. Lines from Beira, in Portuguese East Africa, join those of Northern Rhodesia and give connection with the Belgian Congo.

Eurasia. The mileage of railways in Europe is very great. Through Russia the chief railways of Europe are now joined to the Trans-Siberian Railway, which touches the Pacific at Vladivostok, and with the railways of Turkestan. The Berlin, Vienna, Constantinople, Baghdad, Basra railway, designed to join the Baltic to the Persian Gulf, is nearly completed.

India and Japan are well supplied with railways, and the progressive state of Siam in Further India has now its capital linked to Singapore.

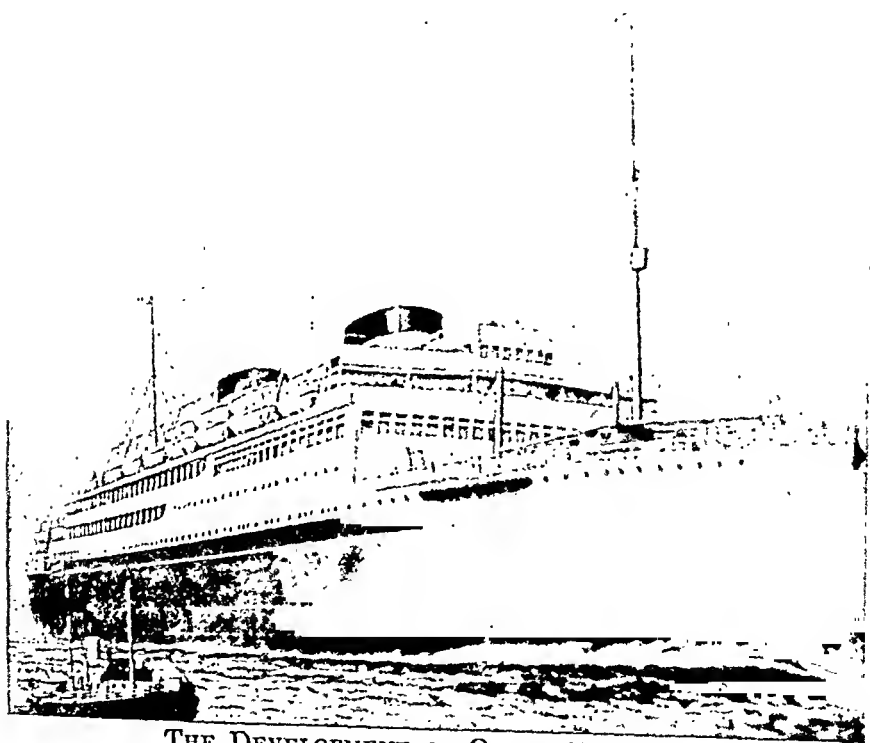
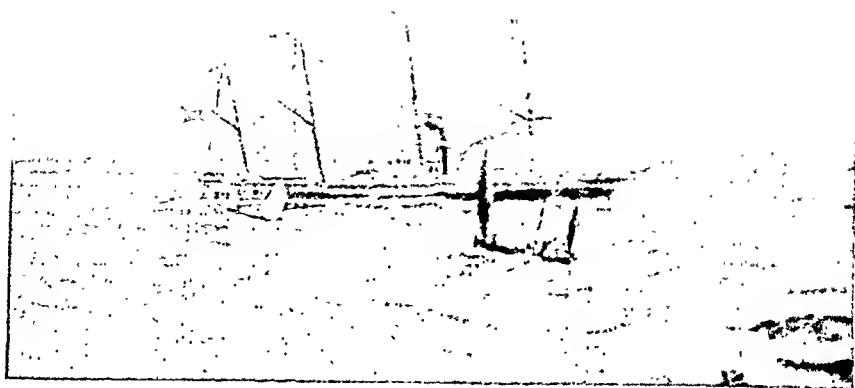
Australia. The railways of Australia were at one time just short lines running from each state capital along the coast, and inwards to mining and sheep-farming areas. Now there is complete coastal communication from Perth, on the west, to Brisbane, on the east, but the different gauges make nine changes of coach necessary on the way.

A line starting at Adelaide and planned to run from south to north has reached almost the centre of the continent, at Alice Springs. The northern section from Port Darwin is still a long way from meeting it.

A telegraph line has been laid right through Australia from north to south.

EXERCISES

1. Name the principal ports at the Pacific ends of the trans-continental railways of North America.
2. Take each port in Question 1 and say where you think the steamships go which leave it and what cargoes they carry.
3. From your atlas work out the easiest way into the interior of the U.S.A. from the Atlantic south of the St. Lawrence.
4. Why is the Panama Canal a great help to the trade of the U.S.A. ? Why do the railroad managers of the states regret the Panama Canal ?
5. Make sketch maps to show the wheat route from Manitoba in (i) summer ; (ii) in winter.
6. Why has a railway been made to the shores of Hudson Bay from Winnipeg ?



THE DEVELOPMENT OF OCEAN TRANSPORT

Top : the S.S. "Great Western" leaving Liverpool in 1838 on her maiden voyage to New York (from a print lent by the Parker Gallery, Berkeley Square, London). *Bottom* : the "Britannia," a giant motor vessel of to-day, belonging to the White Star Line.

XXI. OCEAN TRANSPORT

Modern nations seek ever an open road to the sea, and free access over the ocean to the far ends of the earth. The Russians, for example, under Czar Peter the Great (1682-1725), strove strongly to gain access to the Baltic, and in 1703 founded the city of St. Petersburg, now Leningrad. For many years they aimed also at Constantinople, and in the 19th century they extended their empire right across Asia to Vladivostok on the Pacific.

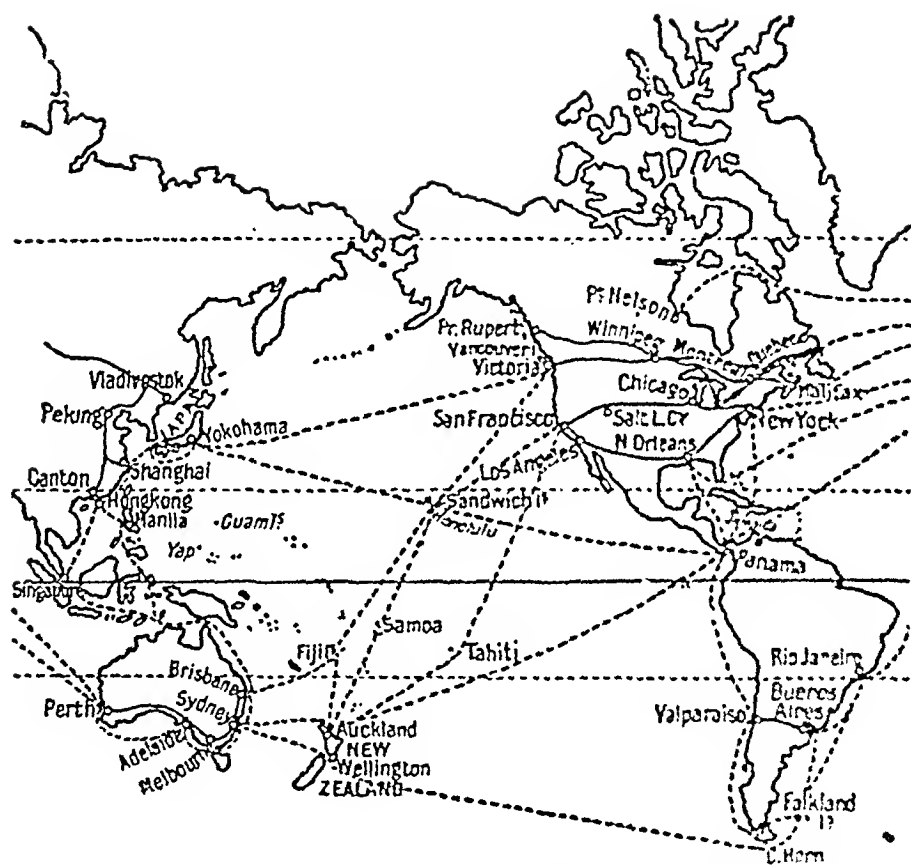
Sea-carriage is cheaper than railway carriage, more convenient and more direct.

Sailing vessels, though still fairly numerous, now represent barely 3 per cent. of the total of the world's shipping. Coal-driven and oil-driven ships have almost entirely supplanted them. They are still employed in the transport of timber from Scandinavia to Great Britain.

Coal was until 1914 the chief source of power for ships. Now one out of every three ships afloat uses oil-fuel, and the number of oil-driven vessels is steadily increasing. This may be beneficial to countries which have large supplies of natural oil—the U.S.A., Mexico and Persia—but it is seriously injuring the South Wales coal trade. It is also reducing the number of men employed on board ship, for oil-driven vessels do not require stokers; the oil can be made to run gently from tanks or cisterns direct to the engine boilers.

A notable feature of the steam- and oil-driven traffic of the 20th century is the great increase of regular "liners," ships which run to a time-table from port to port. Sailing ships could not do this; they were at the mercy of the winds and waves. Tramps still run as and where they are wanted.

Via Suez. The great highway from Western Europe to the East runs through the Mediterranean Sea to Port Said, at the northern entrance to the Suez Canal, and then on through the Red Sea. At the southern end of the Red Sea the stream of traffic divides. Some ships go to Bombay and Karachi; some go to Colombo, in Ceylon; some make straight across the Indian Ocean to Perth and other Australian ports (see map on pp. 152-3).



PRINCIPAL RAILWAYS AND SEA

Ships that go to Colombo divide again—for Calcutta; for Rangoon, in Burma; for Singapore; and then for Hong-Kong, China and Japan.

Tramps—to save the costly Suez Canal dues—often go to Australia and the East round the Cape of Good Hope.

To the Cape. The African trade has steamship lines of its own. Regular services run to West Africa from Liverpool and other ports, calling at the Canaries or Madeira. Other services, based largely upon Southampton, serve Cape Town and South Africa generally.

Certain steamers go round from Cape Town to Durban in Natal. North of Durban, most of the East African trade passes south through the Suez Canal, and not round the Cape.

Atlantic Routes. The busiest routes are those between North America and the British Isles, Germany and France. The northerly service to the St. Lawrence ports, Quebec and Montreal, is closed by ice from December to May; in the winter months Halifax and St. John are the Canadian ports. Between Liverpool and New York run a very large number of liners remarkable alike for their size, their speed, and their regularity.

In this St. Lawrence and New York trade ought to be counted, perhaps, the Great Lakes service. The tonnage using the lakes, and passing through the Soo Canal, exceeds in bulk that of either the Suez or of the Panama Canal. Some day it is hoped that the St. Lawrence will be canalized. Ocean-going ships will then be able to cross straight from Great Britain to the ports at the far end of Lake Superior.

From the Gulf ports of New Orleans and Galveston 90 per cent. of the cotton export of the U.S.A. is made. The West Indies have lines of ships for the sugar and banana trade.

To South America boats sail regularly to Rio Janeiro and Santos for coffee; to the Plate ports of Buenos Aires and Monte Video for meat and wheat and hides. The farther route round Cape Horn has become comparatively unimportant since 1914, when the Panama Canal was opened (see p. 8).

The Panama Canal. Much of the trade through the Panama is domestic trade between the western states of

the U.S.A. and the eastern. The route through to Peru and Chile, however, has greatly increased the trade between the eastern ports of the U.S.A. and those two countries. Wheat too, from the western prairies, also timber from Oregon, are now sent through the canal; at one time these things were railed eastwards, and then shipped through the Great Lakes.

The Suez route between Great Britain and Australia is slightly shorter than the Panama route. The latter, however, is the shorter between Great Britain and New Zealand.

Pacific Routes. The main Pacific routes are as follows:

1. Vancouver, in British Columbia, to Yokohama, in Japan;
2. San Francisco direct to Yokohama or via Honolulu;
3. Panama to Yokohama, and on to Shanghai, Hong-Kong and Singapore;
4. Vancouver, through Honolulu southward, via Samoa or Tahiti, to Auckland and Sydney;
5. Panama (a continuation of the voyage from Great Britain) to New Zealand and Australia.

A Time-Table. The table below shows approximately how long it takes a trading ship sailing from London, via the Suez Canal, to get to various ports; mail boats are quicker:

Gibraltar	. . .	4 days	Singapore	. . .	28 days
Port Said	. . .	8 „	Sydney	. . .	42 „
Bombay.	. . .	21 „	Wellington	. . .	45 „
Colombo	. . .	23 „			

New York can be reached from London in six or seven days; Quebec and Montreal in from ten to fourteen days.

EXERCISES

1. From a scale map work out the approximate distances to each of the ports mentioned in the previous chapter.
2. Would you say that Singapore was more important than Aden or not? Give reasons.
3. What are the main exports from Sydney, Singapore, Bombay, Wellington, and Karachi?
4. What value would it be to trade if the wheat-ships could sail direct from Port Arthur on Lake Superior?
5. Make sketch maps to show sea-routes across (a) the North Atlantic; (b) the Pacific; and (c) the Indian Oceans.

XXII. FINANCE AND BANKING

The basis of all commerce is barter. One man exchanges something he thinks he can do without for something which he thinks he would like.

Notwithstanding the complexity and monstrous size of modern commercial transactions, "goods" bought still are paid for by "goods" sold. The payment may not be made direct between the two dealers. Indeed, there may be several intermediaries. At some time, however, sooner or later, "goods" bought are paid for by other "goods" sold—or by work or services, which may be classed as "goods."

Money. When men found barter, the direct form of "swopping," to be clumsy and cumbersome, they began to give in exchange for goods something that *any* other man would be likely to accept for goods he had to spare. This something varied from cattle or cowrie shells, and tobacco or dried cod, to lumps of metal that shone, were good to wear as ornaments, and were not too plentiful. The lumps of metal in course of time were made into money—i.e. into coins which, stamped, guaranteed, and of a given weight, became a recognized medium of exchange.

Men rarely want "money" for its own sake; they want it for what it will bring in goods—now or later. Money has these advantages: it can be stored, saved, or hidden; also it can easily be carried about—much more easily than a live sheep, or a load of hay or of corn. Moreover, during reasonably short periods, gold or other moneys do not change in value as compared with meat, wheat or wine.

At one time, having come to look on it as an all-important possession, people stored up money in old stockings, in strong boxes, under the beds, and lived in terror of thieves and burglars. The father of Alexander Pope, the poet, when he retired from business, is said to have taken with him a strong box containing £20,000 from which he drew when he wanted to buy things. A man would not do that to-day. He would invest his money. £20,000, wisely invested, would now bring in an income of about £1,000 a year. Meanwhile, the

capital sum would not only remain intact, but would be helping to develop some business, instead of lying idle.

Banks. The business of the 20th century could not be conducted for a single day without the aid of banks. Traders could not carry about with them enough money to pay for all their various transactions; under present conditions, payments mostly take the form of promises which the banks make good. The gold coins of Great Britain are, in the main, held by the banks, which, in turn, send most of their actual coined money to the Bank of England. There is stored as much as may be thought necessary.

People now make their everyday payments by means of *notes*, which the Bank of England promises to exchange for money, on demand. Rarely, however, does the holder of a note ask for gold; he thinks the Bank is safe, and is content to take the promise.

Bigger payments are made by means of *cheques*, another form of paper money. Mr. Jones, for instance, may have bought £1,000 worth of woollen yarn from Mr. Brown; Mr. Brown has bought £1,200 worth of wool from Mr. Robinson; and Mr. Robinson owes £800 for wool to a man in Australia. What happens? Mr. Jones does not count out £1,000 in notes or gold and take it to Mr. Brown so that he may pay part of the £1,200 he owes to Mr. Robinson, who then sends 800 gold coins to Australia. No money passes between them. The whole transaction is completed by cheques, which are written orders to the banks at which Messrs. Jones, Brown and Robinson keep their money.

Mr. Jones gives Mr. Brown a cheque for £1,000; Mr. Brown gives Mr. Robinson a cheque for £1,200; Mr. Robinson writes a cheque for £800 and sends it to the man in Australia. Each hands the cheque he has received to the bank he uses. That bank sends it to a *clearing-house* where all the cheques are dealt with. The clearing-house sees the cheque goes to the particular bank which has to pay it. That bank enters the amount under the man's total in a column of figures. Thus Mr. Jones now finds that he has £1,000 less money to his account, and the man in Australia finds that he has £800 more. Yet the actual money has been quite still all the time in the Bank of England.

The clearing-house also arranges each bank's own totals. If Bank A sends in 100 cheques due to be paid to it, and 99 due for it to pay come in from other banks, the clearing-house adds up the 100, then adds up the 99, and the difference for or against Bank A is added to its account, or subtracted from it, as the case may be.

Of course, it is no use Mr. Jones, in the first instance, writing a cheque for £1,000 unless he has that amount, or more, to his credit in his bank account.

Bills. When a man in Australia loads wool on a ship, the captain signs a "*bill of lading*." This serves as evidence that the wool is there, on board; and the exporter, if he wishes, can use it, in conjunction with a *bill of exchange*, to raise money, or credit, at once, instead of waiting for payment to reach him from London.

A bill of exchange is an order to pay, drawn by the creditor. The debtor accepts it by signing it; and it then becomes the property of the drawer.

Bills of exchange can be passed on to other people almost as if they were money. Banks readily take them, pay out money on them, and wait for the account to become due.

But banks do not pay out the full amount; they *discount* the bill, charging at the rate of so much per cent. per year. The rate varies according as there are many bills on the market, or few.

The way in which trade is carried on between, say, Brazil, the U.S.A. and Great Britain will serve, perhaps, to show how "bills of exchange" help commerce.

Brazil grows and exports coffee—mostly to the U.S.A.; Great Britain buys wheat and cotton from the U.S.A. Brazil buys many kinds of manufactured goods from Great Britain. Yet practically no money passes from one country to another. When coffee goes to the States, bills are drawn and accepted in payment, or as promises of payment. Similarly, bills are drawn and accepted when wheat and cotton go to Great Britain, and when manufactured goods are sent to Brazil. Certain classes of banks deal exclusively in these "accepted" bills.

Say that a New York accepting house has "bills" drawn to

pay Brazil, others drawn to pay for wheat and cotton, and others to pay for manufactured goods from Great Britain; and suppose the total of each to be £10,000. The £10,000 due for coffee pays the £10,000 due for manufactured goods; and the £10,000 due for manufactured goods pays the British bills for wheat and cotton. No money passes and, although the accepting banker has probably done a good business in dis-



[Photo: E.N.A.]

LOADING THE AIR-MAIL AT CROYDON,

near London. Regular air-mail services are now maintained not only between England and the Continent of Europe, but between England and even the distant parts of the Empire.

counts, everybody is saved the worry and trouble and risk of moving gold. Thus "goods pay for goods," even between three different countries, though sometimes the amounts due on balance from one to another may be so great that gold has to be moved to settle.

One condition of such methods of doing business is that the "credit" of all parties must be good. Their promises must be reliable, there must be no failure to pay; and the

accepting houses must have plenty of capital behind them. "Capital" is absolutely necessary to finance modern business.

Communications. The easy means of communication made possible by telephone, telegraph and cable are a great help to modern business men. Years ago, when it took six months to get to Australia, and six months to get back, an answer to a letter of inquiry could not be received under a year. Now an answer can be got in as many seconds as before it took days.

Air-ways at present are useful for rapid communication rather than for transport of goods. The first air-mail to Australia left England in April, 1931, and carried 15,000 letters. Services have now been established to India and South Africa. Ere long, all parts of the Empire will doubtless be linked up in this way.

EXERCISES

1. Make a diagram to show graphically the time taken to get to Australia (a) by a sailing ship ; (b) by tramp steamer ; (c) by mail-boat, and (d) by air-way.
2. What is meant by "barter" ? Why was it an awkward and cumbersome method of doing business ?
3. Why was money so very useful in early trade ?
4. What are the "characteristics" of good "money" ?
5. Is gold of any other use than as a medium of exchange ? Why is it wanted for other things than money ?
6. What is meant by (a) a bill of lading ; (b) a bill of exchange ; and (c) an invoice ?

